NOTE

This manual documents the Model 752A and its assemblies at the revision levels shown in Appendix 7A. If your instrument contains assemblies with different revision letters, it will be necessary for you to either update or backdate this manual. Refer to the supplemental change/errata sheet for newer assemblies, or to the backdating sheet in Appendix 7A for older assemblies.

752A
Reference Divider

Instruction Manual

P/N 645069
MAY 1983 Rev. 1 4/84

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5/94

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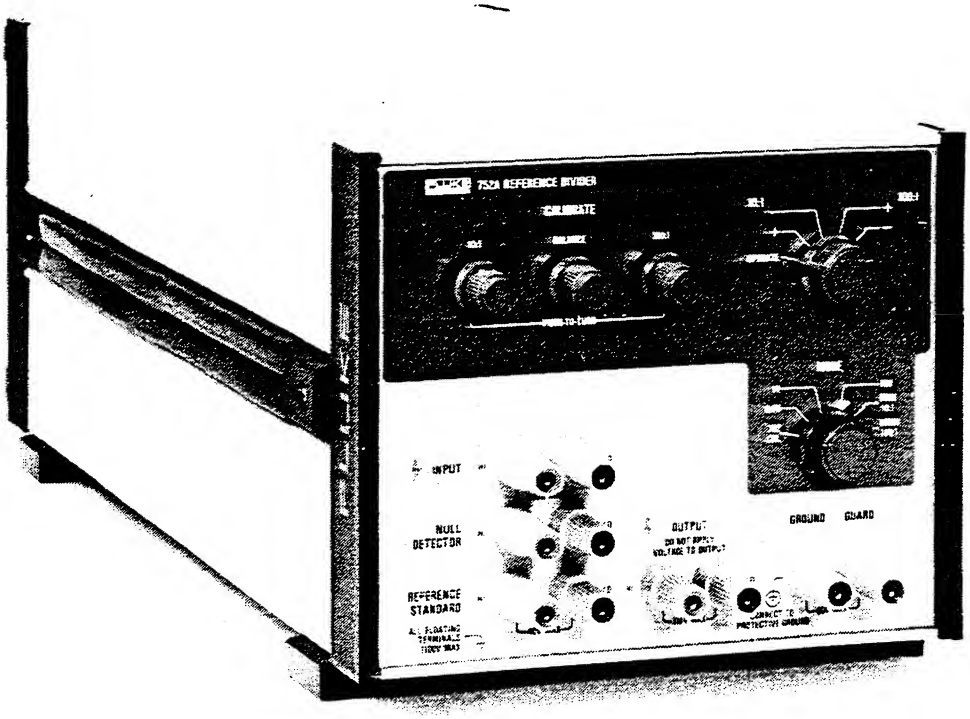


Model 752A Reference Divider

Section 1
Introduction and Specifications

1-1. INTRODUCTION

1-2. The John Fluke Model 752A is a self-calibrating, precision dc voltage divider with two ranges of division: 10:1 and 100:1. In addition to the two divider ranges, the 752A incorporates switching modes used in the cardinal point calibration of dc voltage calibrators. The points provided on the 752A are 0.1V, 1V, 10V, 100V, and 1000V. When the 752A is combined with a dc voltage calibrator, a 10V reference standard, and a null detector, the 752A switches the equipment to standardize the dc voltage calibrator without having to physically change the leads.

1-3. The 752A is self-calibrated before each use. This procedure requires a stable source and a null detector. The 752A is a ratio device only, and does not have to be included in a calibration cycle that is traceable to an external standard.

1-4. The front panel MODE switch selects between self-calibration and normal operation. In the Self-Calibration mode, the voltage divider resistors are compared using an external null detector to an internal, self-calibrating bridge to precisely set their overall value, and hence, the division ration of the 752A. The three push-to-turn CALIBRATE controls adjust the 10:1 divider, 100:1 divider, and the self-calibration bridge. The CALIBRATE switch selects the divider to be calibrated and interchanges the two resistors in the self-calibration bridge to check that they are of equal value. If not, the BALANCE control adjusts one of these resistors by a small amount to make both self-calibration bridge resistors equal in value.

1-5. In normal operation, the MODE switch settings correspond to the cardinal calibration points of a dc voltage calibration system. The MODE switch now interconnects the external equipment in one of three ways (refer to Figure 2-3):

1. The voltage divider of the 752A is connected between the reference standard and the null detector as shown in Figures 2-3a and 2-3b.

2. The voltage divider is out of the circuit and the reference standard is compared directly with the UUT (unit under test) as shown in Figure 2-3c.

3. The voltage divider is connected between the UUT and the null detector as shown in Figures 2-3d and 2-3e.

1-6. The OUTPUT terminals are always connected to the output of the Voltage Divider. The OUTPUT terminals are used when the 752A is used as a stand-alone voltage divider.

1-7. SPECIFICATIONS AND ACCESSORIES

1-8. The accessories available for the 752A are listed in Table 1-1 and described in more detail in Section 6 of this manual. The specifications for the 752A are listed in Table 1-2.

Table 1-1. Accessories

MODEL NUMBER	DESCRIPTION
M00-800-523	Dual Mounting Fastener
M07-203-603	Half Width Rack Mount Kit
M07-200-601	Full Width Rack Mount Kit
5440A-7002	Low Thermal EMF Cable Assembly

Table 1-2. 752A Specifications

RATIO RANGES 10:1, 100:1

RATIO ACCURACY* ..... 18°C to 28°C

Range	Input Voltage	Accuracy Of Output
10:1	100V	0.2 ppm
100:1	1000V	0.5 ppm

INPUT RESISTANCE

100:1 Divider

DIVIDER ..... 4 Megohms

DRIVEN GUARD ..... 4 Megohms

TOTAL ..... 2 Megohms ±1%

10:1 Divider ..... 380 kilohms ±1%

MAXIMUM INPUT VOLTAGE

10:1 Ratio ..... 200V maximum**

100:1 Ratio ..... 1100V maximum

POWER COEFFICIENT EFFECT ON RATIO***

10:1 Ratio ..... <0.05 ppm of input @ 100V

100:1 Ratio ..... <0.3 ppm of input @ 1000V

DIMENSIONS (HxWxD) ..... 19.1 cm x 22.1 cm x 60.3 cm (7.5 in x 8.5 in x 23.7 in) (See Figure 1-1)

WEIGHT ..... 8.4 kg (18 lbs 8 oz)

COMPLIANCE WITH EXTERNAL STANDARDS ..... ANSI C39.5 Draft #8
IEC 348 2nd edition, 1978
CSA Bulletin 556B, 17 Sept. 1973
VDE 0411-1973
UL 1244

OPERATING TEMPERATURE ..... 0°C to 40°C

ALTITUDE

Non-operating ..... 0-12,200 meters (40,000 feet)

Operating ..... 0-3,050 meters (10,000 feet)

TEMPERATURE AND HUMIDITY

Condition	Temperature (°C)	% Relative Humidity (Non-condensing)
Non-operating	-40 to +75	Not Controlled
	0 to 50	95 ±5%
Operating	0 to 30	80 ±5%
	30 to 40	75 ±5%
	40 to 50	45 ±5%

Table 1-2. 752A Specifications (cont)

VIBRATION ..... Per MIL 28800C Class 5

*Ratio accuracy specification applies for eight (8) hours following self-calibration, provided that the instrument is operated at a constant temperature equal to the calibration temperature ±1°C and provided that the instrument was allowed to stabilize for a period of not less than four (4) hours prior to self-calibration in a thermally stable environment.

**This specification applies to the safety of the 752A only. The maximum voltage for best accuracy is 100V.

***This is included in the 100:1 Ratio Accuracy specification.

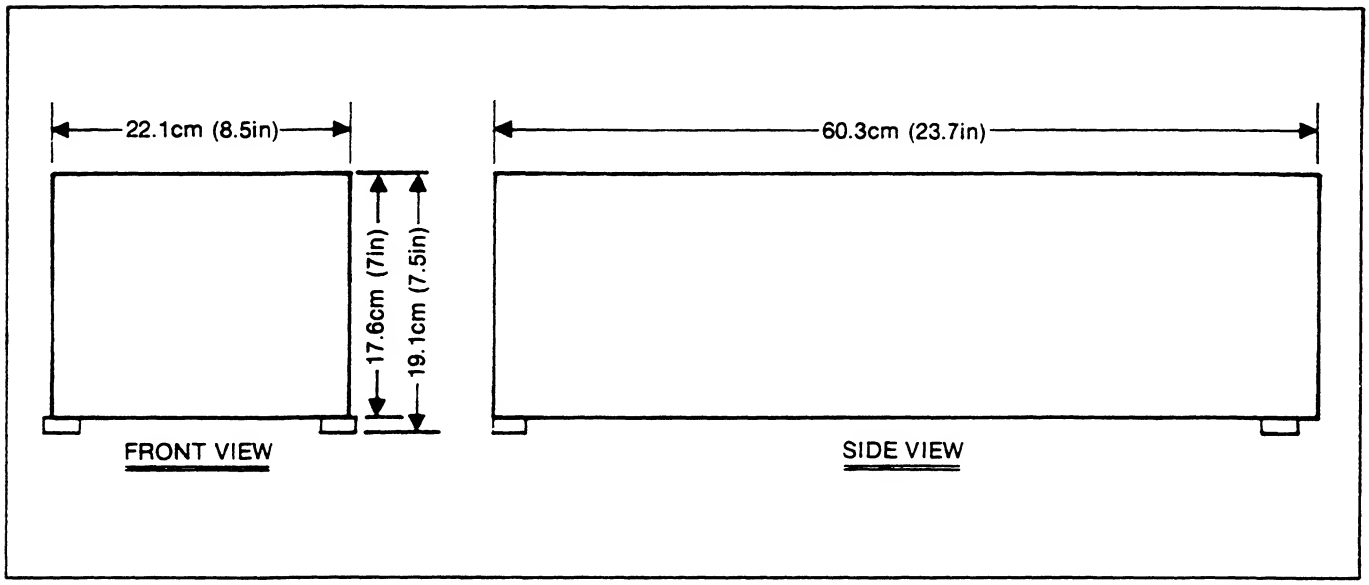
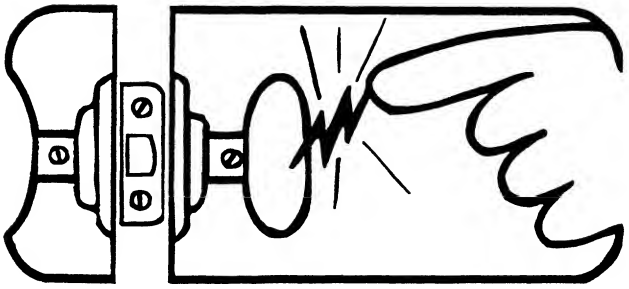


Figure 1-1. Model 752A External Dimensions

static awareness

A Message From

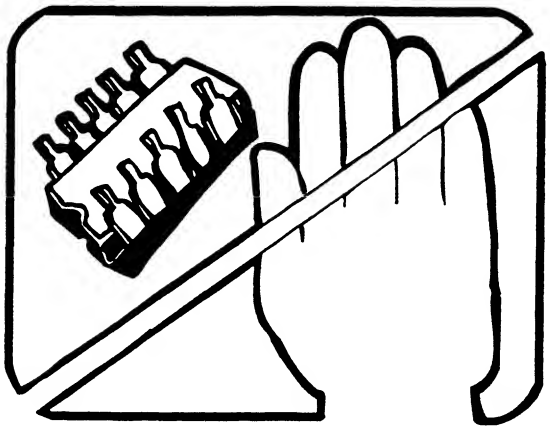
John Fluke Mfg. Co., Inc.



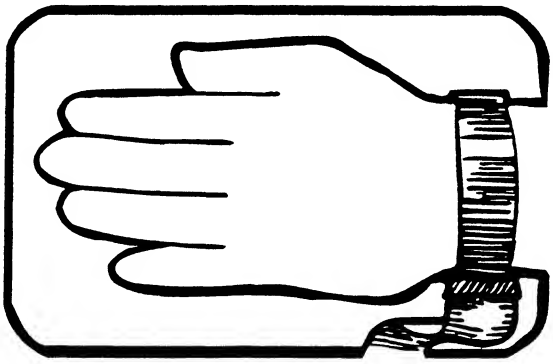
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Leaning the guidelines for handling them.
3. Using the procedures, packaging, and bench techniques that are recommended.

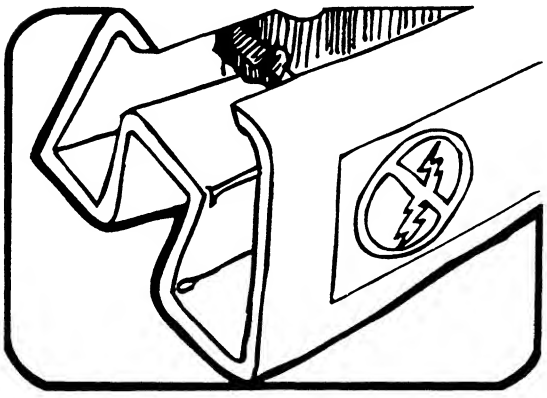
The following practices should be followed to minimize damage to S.S. (static sensitive) devices.



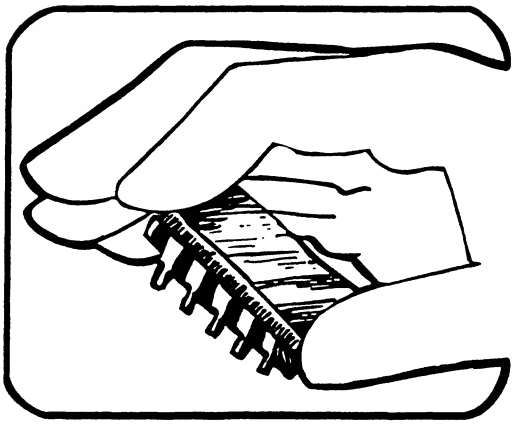
1. MINIMIZE HANDLING



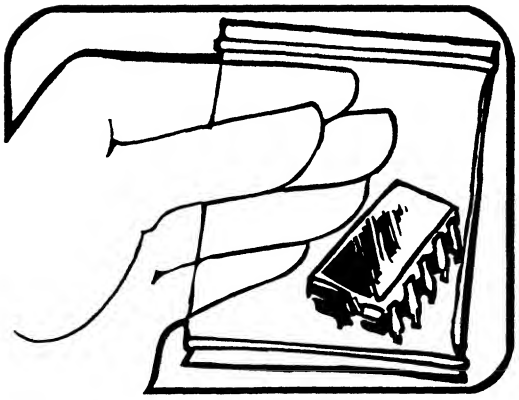
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES. USE A HIGH RESISTANCE GROUNDING WRIST STRAP.



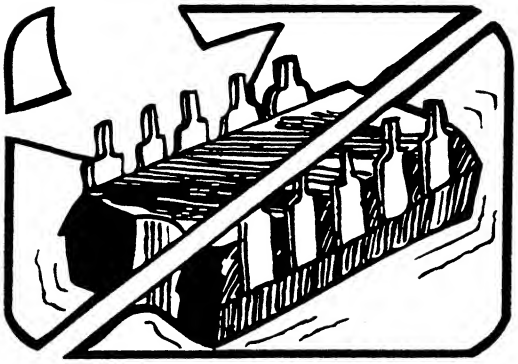
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



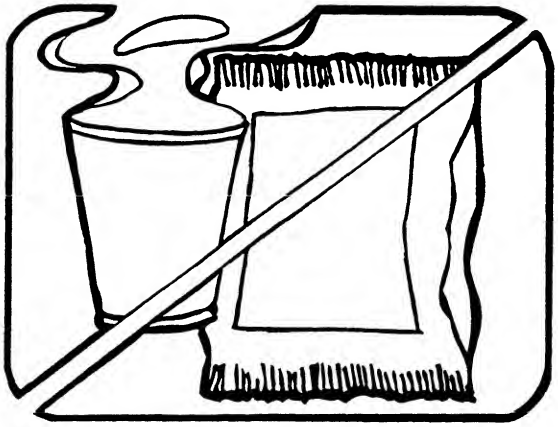
4. HANDLE S.S. DEVICES BY THE BODY.



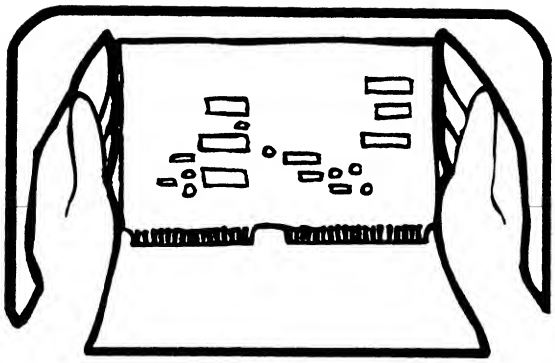
5. USE STATIC SHIELDING CONTAINERS FOR HANDLING AND TRANSPORT.



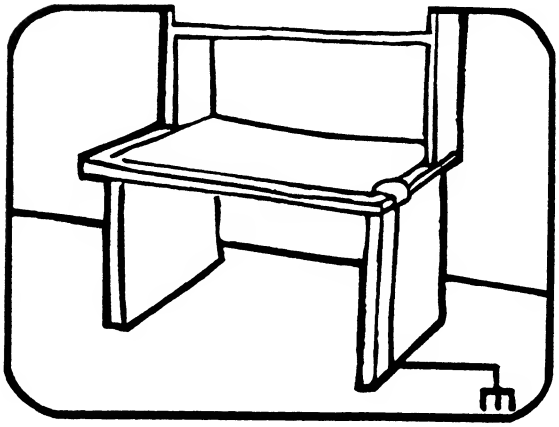
6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE.



7. AVOID PLASTIC,VINYL AND STYROFOAM® IN WORK AREA.



8. WHEN REMOVING PLUG-IN ASSEMBLIES HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR HELPS PROTECT INSTALLED S.S. DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION.

10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

11. ONLY GROUNDED-TIP SOLDERING IRONS SHOULD BE USED.

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Section 2
Operation

2-1. INTRODUCTION

2-2. The information in this section describes the installation and operation of the Model 752A. It is recommended that the contents of this section be read and understood before any attempt is made to operate the instrument. Should any difficulties arise during operation, contact your nearest John Fluke Sales Representative, or the factory. Our mailing address is: John Fluke Mfg. Co., Inc.; P.O. Box C9090; Everett, WA 98206 (206) 347-6100.

2-3. SHIPPING INFORMATION

2-4. The 752A is shipped in a foam-packed container. Upon receipt of the instrument, a thorough inspection should be made to reveal any possible shipping damage. Special instructions for inspection and claims are included on the shipping carton. If reshipment of the instrument is necessary, the original container or equivalent should be used.

2-5. INSTALLATION

2-6. The 752A may be operated free standing or rack mounted. A rack mount accessory for the 752A is described in Section 6.

2-7. INPUT LINE POWER

2-8. The 752A is a passive device requiring no external line power.

2-9. FRONT AND REAR PANEL FEATURES

2-10. The front panel features are shown in Figure 2-1. The various controls and connections are listed and explained in Table 2-1. The only connection on the rear panel is a chassis ground connection.

2-11. OPERATING NOTES

2-12. Introduction

2-13. This section describes the use of the guard and ground terminals on the 752A. The Self-Calibration Procedure for the 752A is described at the end of the Operating Notes.

2-14. Guard/Ground Terminals

2-15. Ordinarily, the GUARD and GROUND terminals are strapped together. They may be unstrapped when it is desirable to reference the internal guard circuit to a different potential than ground.

WARNING

LETHAL VOLTAGES MAY BE PRESENT WHEN OPERATING THE 752A WITH THE GUARD AND CHASSIS GROUND CONNECTIONS SEPARATED.

CAUTION

A MAXIMUM POTENTIAL DIFFERNECE OF 60V RMS MAY APPEAR BETWEEN THE GUARD AND CHASSIS GROUND TERMINALS. IF THIS LIMITATION IS EXCEEDED, DAMAGE TO THE INSTRUMENT MAY RESULT.

2-16. Separating the GUARD and GROUND terminals may be necessary to minimize the effect of circulating currents in the ground system of a calibration setup. The GUARD terminals may also be referenced to a different potential than GROUND to minimize the effects of electrical leakage on the characteristics of the 752A's voltage divider.

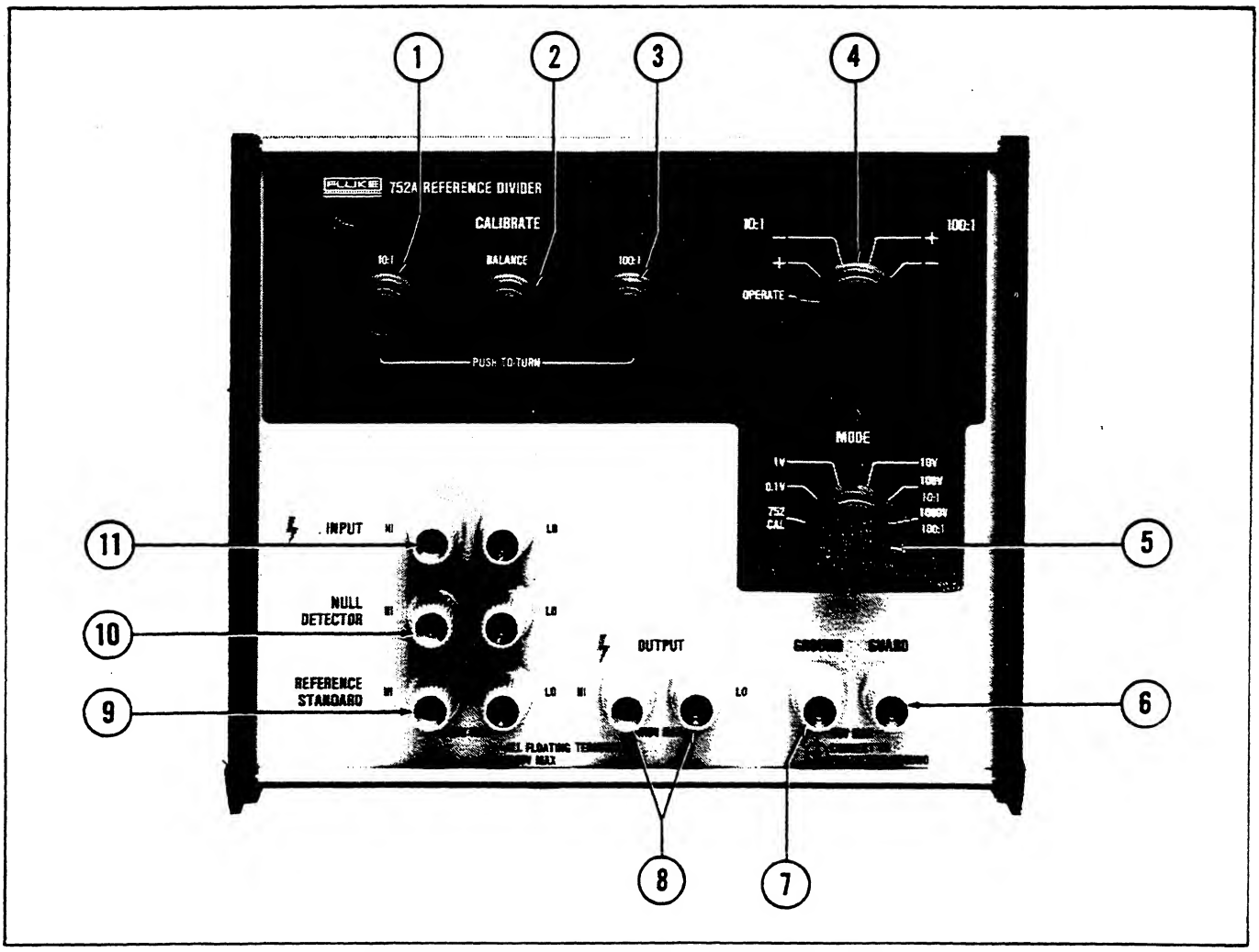


Figure 2-1. Front Panel Controls and Connectors

Table 2-1. 752A Front Panel Controls and Connectors

ITEM NO.	FEATURE NAME	DESCRIPTION
1	10:1 calibration potentiometer	Calibrates 10:1 divider.
2	BALANCE calibration potentiometer	Calibrates internal calibration bridge.
3	100:1 calibration potentiometer	Calibrates 100:1 divider.
4	CALIBRATE switch	Selects normal operation or divider to be calibrated.
5	MODE switch	Selects divider ratio or Cal mode.
6	GUARD terminal	Guard circuit connection.
7	GROUND terminal	Chassis ground connection.
8	OUTPUT terminals	Voltage Divider output.
9	REFERENCE STANDARD terminals	Input from reference standard voltage source.
10	NULL DETECTOR terminals	Output to null detector.
11	INPUT terminals	Instrument input.

Table 2-2. Equipment Required For Self-Calibration

NAME	REQUIRED SPECIFICATIONS	TYPE
Voltage Source	20V, 10 mA	Fluke 5440A
Null Detector	1 μV full scale sensitivity 10 MΩ input resistance	Fluke 845 Null Detector

NOTE

The leakage resistance to the case of the Null Detector should be greater than $10 \times 10^{12}\Omega$. Use the same null detector for both self-calibration and operation.

2-17. Self-Calibration Procedure

2-18. Complete the following procedure to self-calibrate the 752A. The test equipment required is shown in Table 2-2. Equivalent test equipment may be substituted providing it meets the minimum specification given in Table 2-2. Connect the equipment as shown in Figure 2-2.

CAUTION

TO INSURE OPERATION WITHIN THE SPECIFICATIONS LISTED IN SECTION 1, DO NOT ADJUST THE 10:1 OR 100:1 CALIBRATE CONTROLS AT ANY TIME OTHER THAN AS A PART OF THE SELF-CALIBRATION PROCEDURE. THESE CONTROLS ARE PART OF THE DIVIDER CIRCUIT REGARDLESS OF THE POSITION OF THE MODE SWITCH.

CAUTION

TO AVOID CRACKING THE PLASTIC BINDING POST INSULATOR, TIGHTEN ONLY WITH FINGER PRESSURE. DO NOT USE TOOLS.

1. Allow the 752A to thermally stabilize for at least 4 hours in a thermally stable environment (±1°C).

2. Adjust the Voltage Source for 20V output. Leave the output de-energized at this time.

3. Connect the 752A as shown in Figure 2-2.

4. Set the MODE switch to the 752 CAL position.

5. Set the CALIBRATE switch to the 10:1+ position.

6. Energize the Voltage source.

7. Set the Null Detector to the most sensitive range that allows an onscale reading.

8. Note the reading on the Null Detector.

9. Set the CALIRATE switch to the 10:1- position.

10. Note the Null Detector reading. If there is a difference between the reading in the '+' and '-' switch positions, adjust the BALANCE potentiometer such that the Null Detector readings are the same in both the '+' and '-' switch positions.

11. If the Null Detector reading after step 10 is not zero, adjust the 10:1 potentiometer for a null on the Null Detector.

12. Repeat steps 7-11 until the Null Detector has a null reading equal to 0 ± 0.5 μV. If it is not possible to achieve equal Null Detector readings, or if the Null Detector reading exceeds the stated limits, perform the Long Term Drift correction procedure on the self-calibrate bridge as described in Section 4 of this manual.

13. Set the Null Detector to the 1 mV range.

14. Set the CALIBRATE switch on the 752A to the 100:1+ position.

15. Set the Null Detector to the most sensitive scale allowing an onscale reading.

16. Note the reading on the Null Detector.

17. If the Null Detector reading after step 16 is not zero, adjust the 100:1 potentiometer so that the Null Detector indicates a null reading of 0 ± 1 μV.

18. Repeat steps 13-18 until the Null Detector has a null reading equal to 0 ± 1 uV.

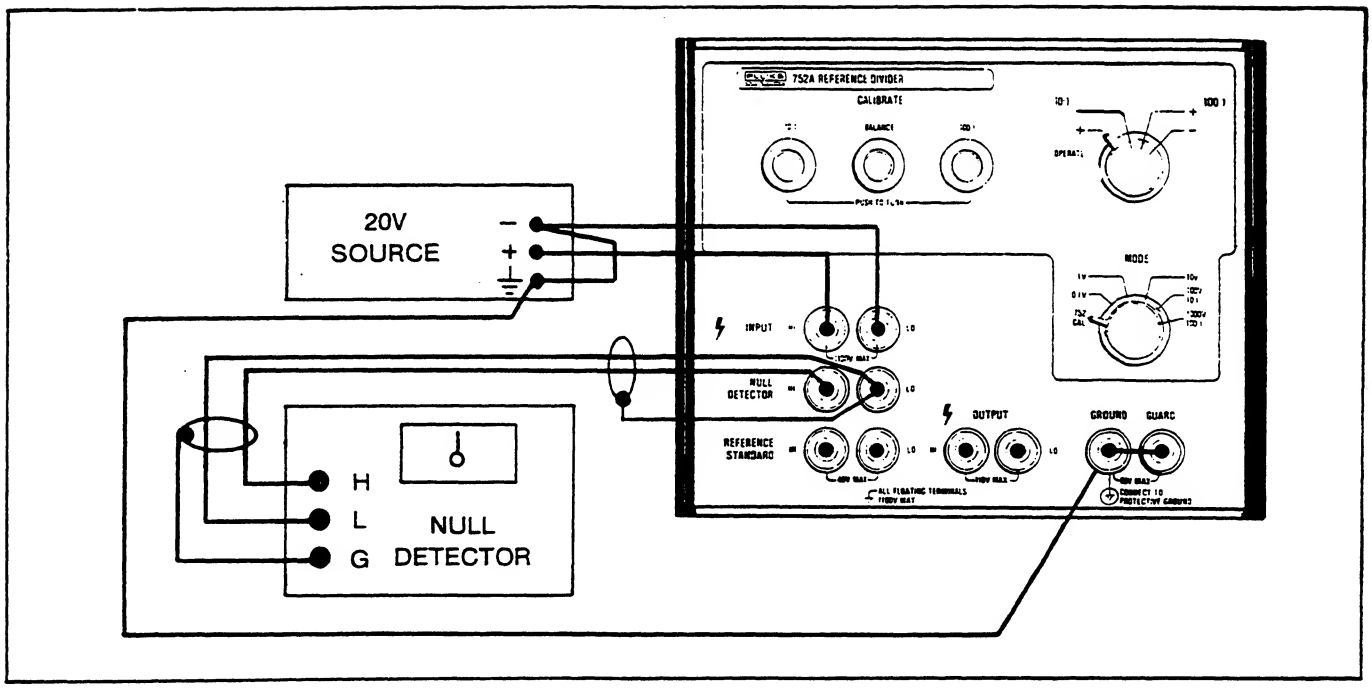


Figure 2-2. Self-Calibration Setup

19. Set the CALIBRATE switch to the 100:1- position and verify the null. If the difference between the 100:1+ and 100:1- switch settings is greater than 0.5 μV, repeat the self-calibration procedure beginning with step 5.

20. If the Null Detector reading exceeds the 0 ± 1 uV limits, perform the Long Term Drift Correction procedure described in Section 4 of this manual. Note the value of the Null Detector reading before proceeding to the Drift Correction procedure.

21. Set the Null Detector to the 10V range.

22. De-energize the Voltage Source.

23. Set the 752A CALIBRATE switch to the OPERATE position.

24. Set the 752A MODE switch to the desired position.

25. The 752A is now ready for use.

2-19. OPERATION

2-20. Introduction

2-21. The following paragraphs descibe operation of the 752A in a dc voltage calibration system and as a stand-along divider. Figure 2-3 shows the various test configurations possible using the internal switching of the 752A. Perform the Self-Calibration Procedure described earlier in this section before using the 752A.

NOTE

To insure performance to the specifications listed in section 1, the 752A must be calibrated and operated in an environment whose temperature change is less than ±1° C from the time of self-calibration to use.

NOTE

To minimize noise effects the null detector terminals are reversed in the 0.1 V and the 1 V configurations; i.e., an input which is low will cause a positive null detector reading.

2-22. Calibration System Operation

2-23. When the 752A is used as part of a calibration system (Figure 2-4), the Unit Under Test (UUT) is connected to the INPUT terminals, the Null Detector to the NULL DETECTOR terminals, and the Reference Standard to the REFERENCE STANDARD terminals. After self-calibration, set the CALIBRATE switch to OPERATE. The MODE switch then determines the interconnection of the precision divider portion of the 752A, Null Detector, UUT and Reference Standard.

2-24. Stand-Alone Operation

2-25. If the 752A is to be used for stand-along operation, the input should be connected to the INPUT terminals and the output should come form the OUTPUT terminals. After self-calibration, set the 752A MODE switch to either the 10:1 or 100:1 positions. Set the CALIBRATE switch to OPERATE. Figure 2-5 shows the 752A used in a typical stand-alone configuration.

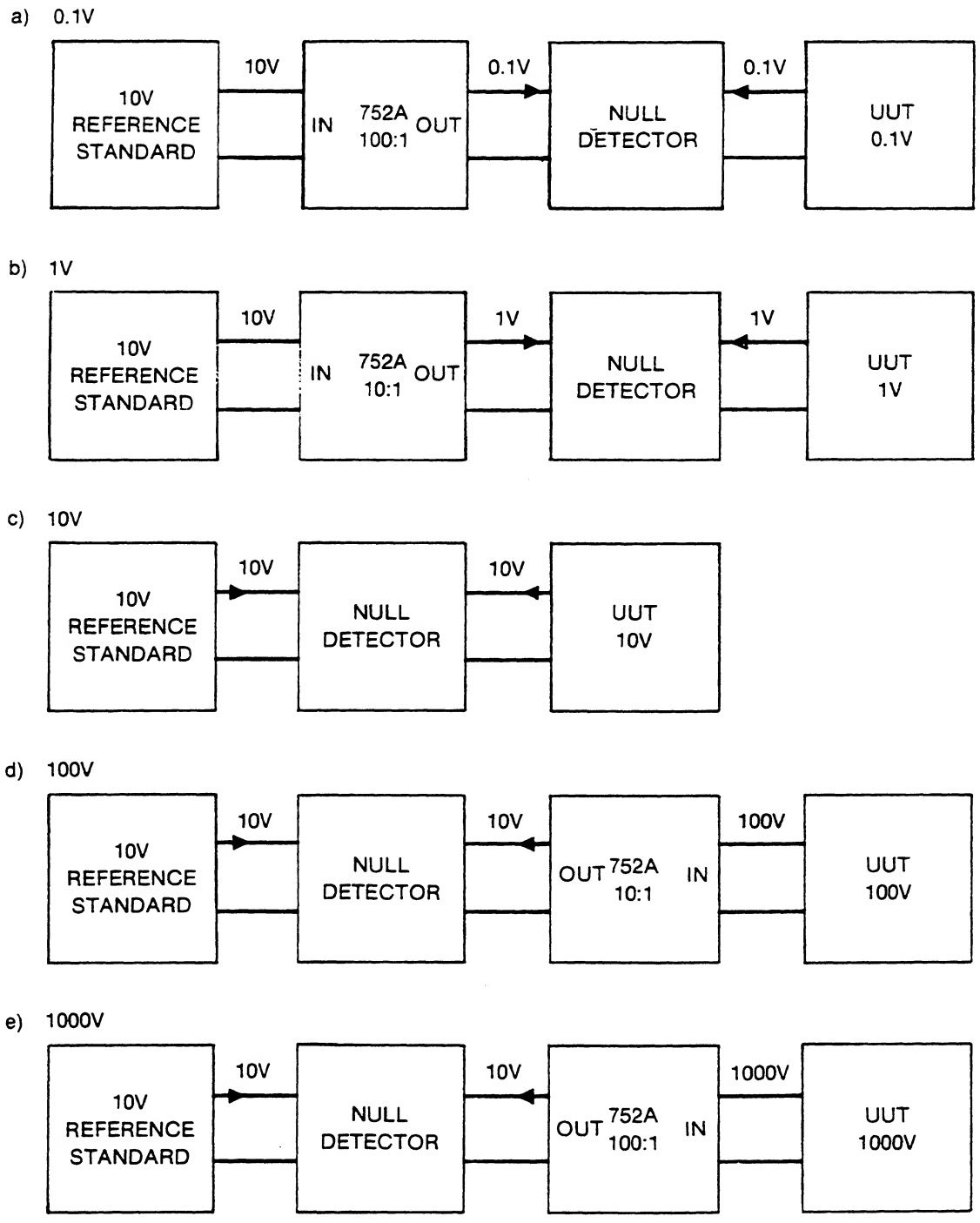


Figure 2-3. Mode Switch Configurations Block Diagram

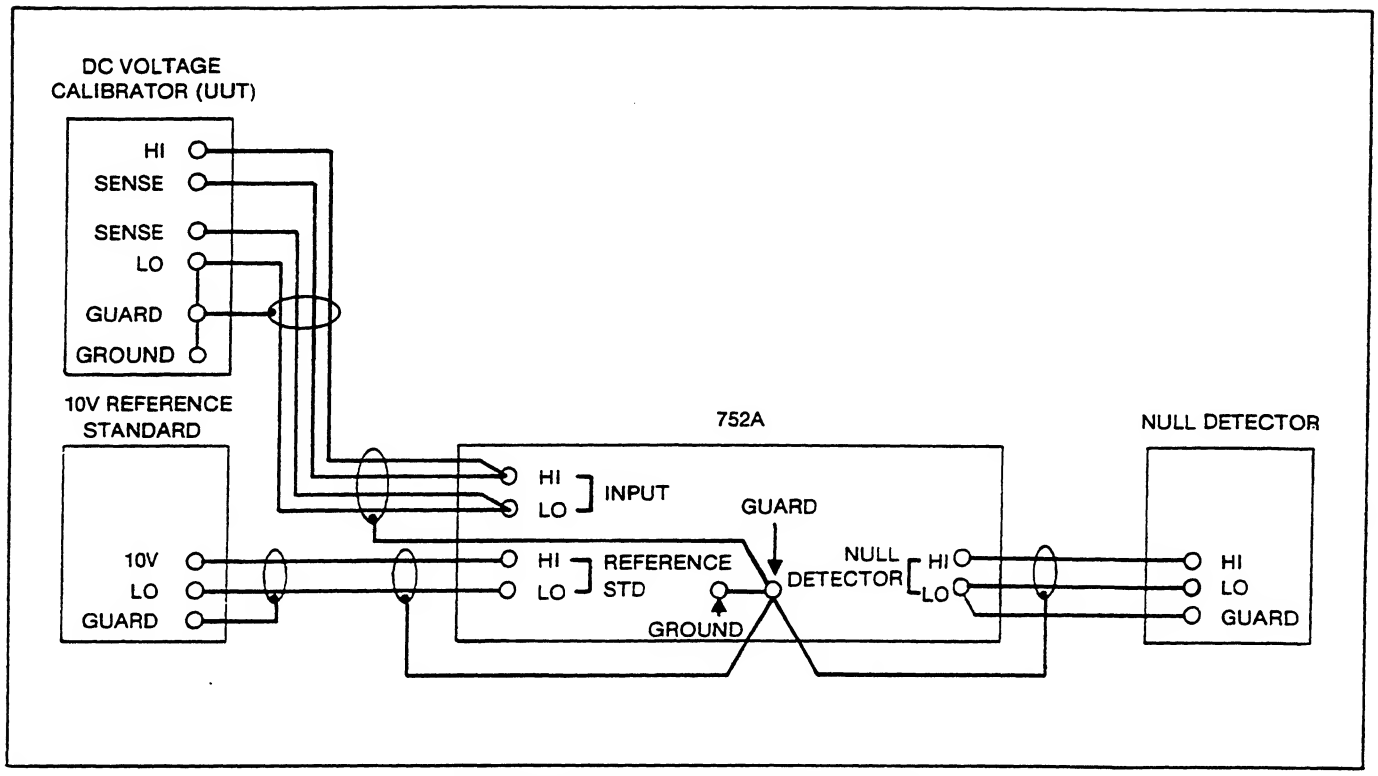


Figure 2-4. Calibration System Operation

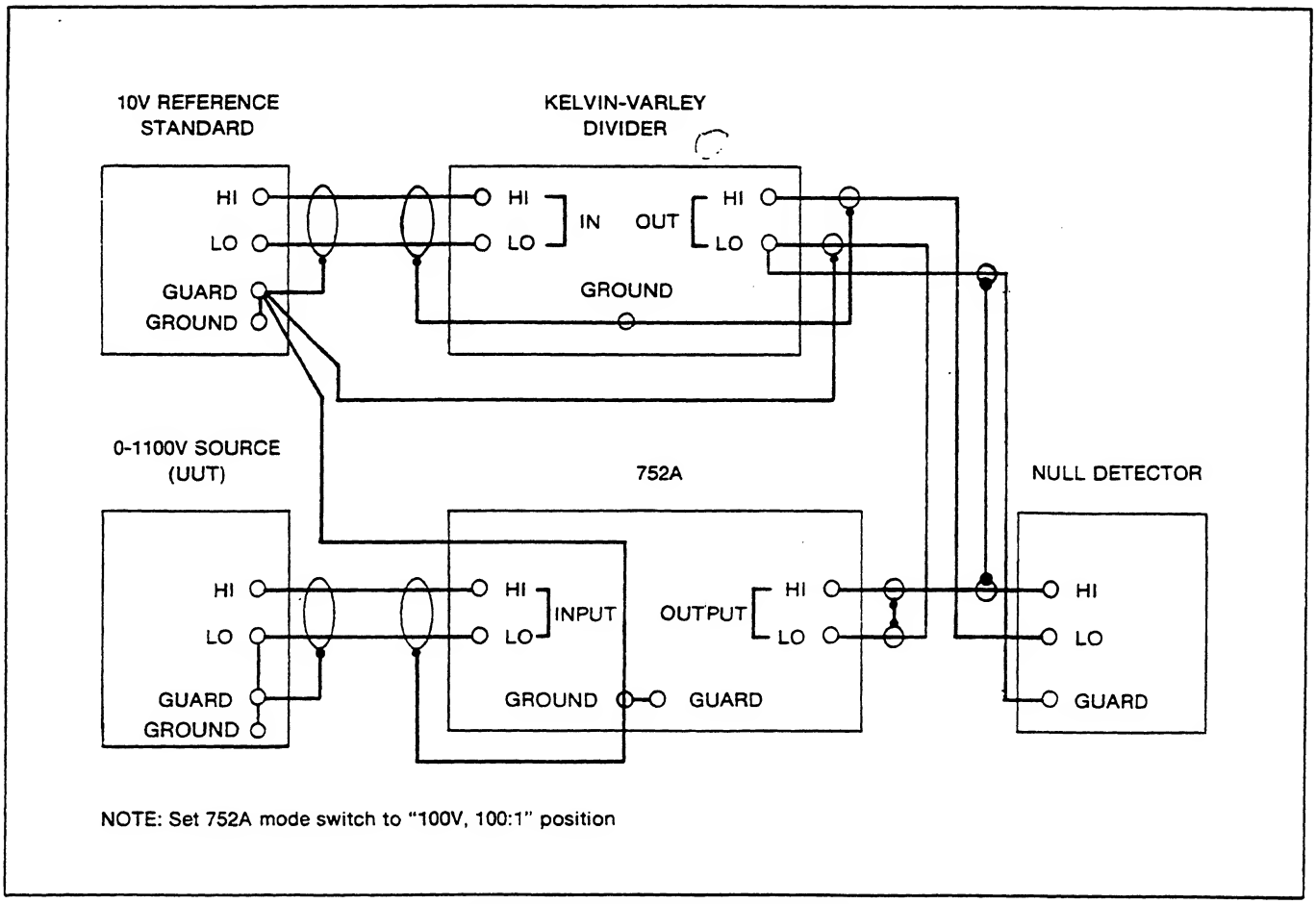


Figure 2-5. Stand-Alone Operation

Section 3
Theory of Operation

3-1. INTRODUCTION

3-2. The information in this section describes the theory of operaton for the 752A. The discussion is supported by a block diagram and simplified schematics in this section and the detailed schematics found in Section 8.

3-3. OVERALL FUNCTIONAL DESCRIPTION

3-4. Refer to Figure 3-1. The 752A is a precision, self-calibrating, 10:1 and 100:1 voltage divider. The 752A has three modes of operation: part of a calibration system, stand-alone 10:1 or 100:1 voltage divider, and Self-Calibration. Dual guard circuits (one driven, one passive) minimize the effects of leakage on the performance of the instrument.

3-5. The effects of short-and long-term drift on the resistors in the 752A is compensated in two ways. Short-term drift is minimized by the Self-Calibration procedure. Long-term drift is corrected by internal strapping on the internal printed circuit assembly. Both dividers and calibration resistors have individual drift compensation networks. The Drift Correction procedure is described in Section 4.

3-6. System Operation

3-7. In this mode, the 752A is used with an external dc reference standard and null detector for the cardinal point calibration of dc voltage calibrators. As shown in Figure 3-2, the MODE switch determines connections to and

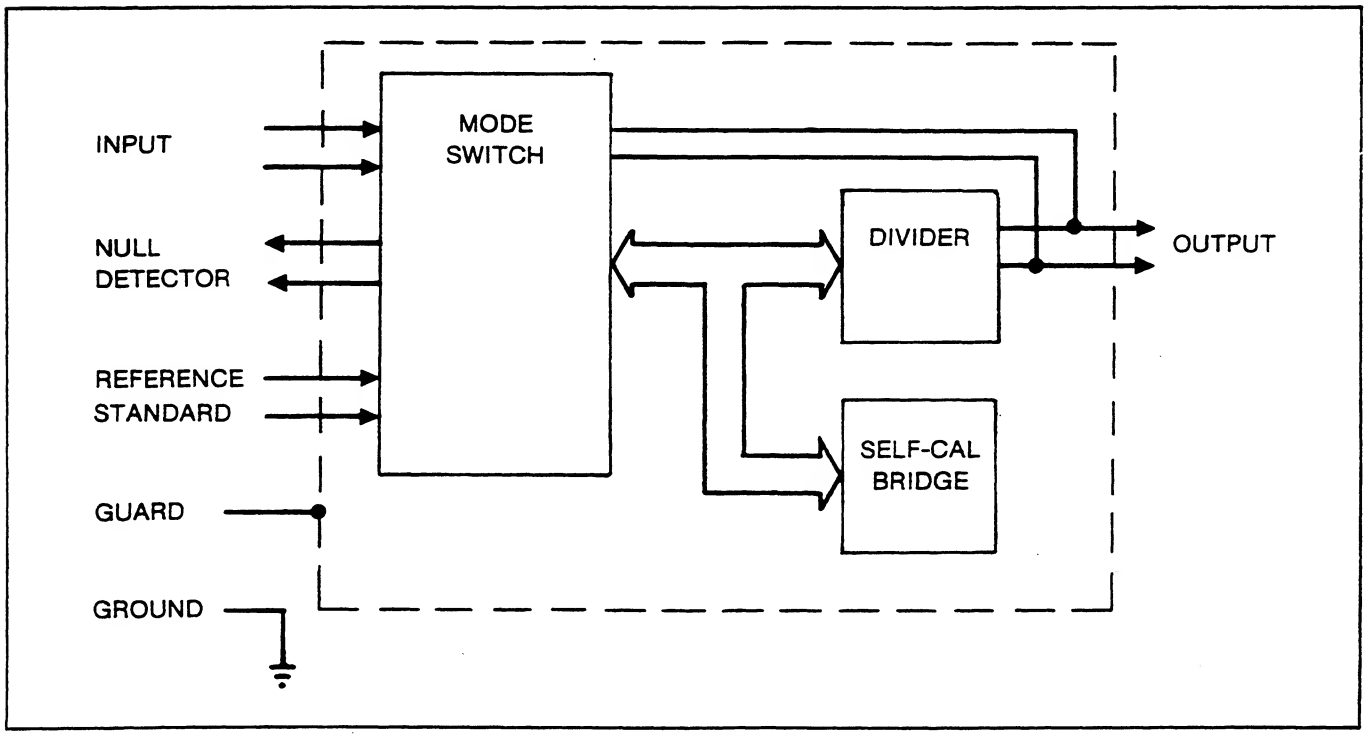


Figure 3-1. 752A Block Diagram

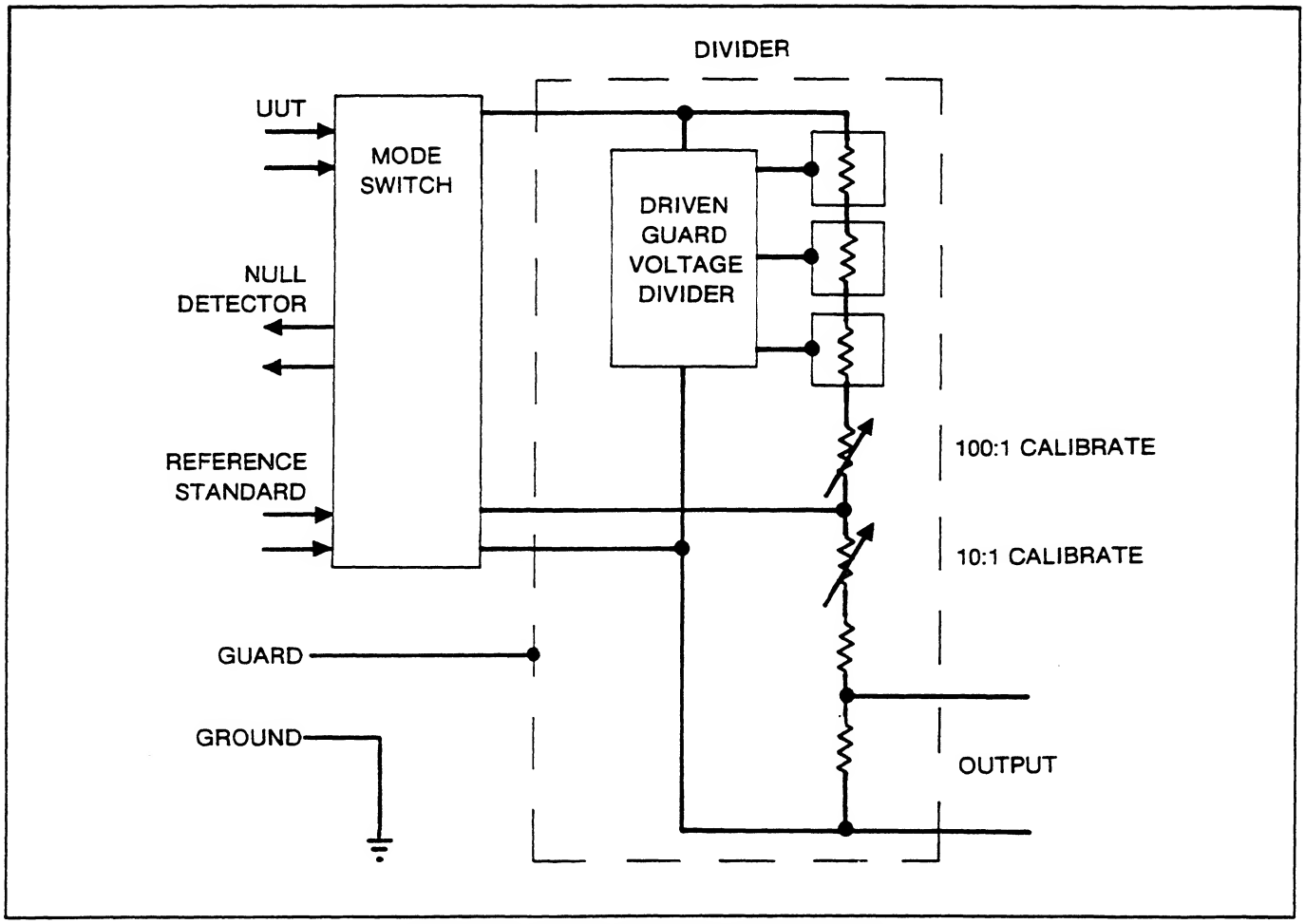


Figure 3-2. System Operation Block Diagram

from the 100:1 and 10:1 dividers, the UUT, dc reference standard, and null detector. This simplifies test procedures by eliminating lead switching for various equipment configurations.

3-8. Stand-Alone Operation

3-9. The 752A may also be used as a stand-alone 10:1 and 100:1 self-calibrating, precision voltage divider (Figure 3-3). The MODE switch connects the INPUT terminals to the 100:1 or 10:1 divider input. The divider output is available at the OUTPUT terminals.

3-10. VOLTAGE DIVIDER CIRCUIT

3-11. The 752A design is based on the concept of a resistive voltage divider. In Figure 3-4, 9R is the input or series resistor, and R is the output or shunt resistor.

3-12. The output resistor is 40 kΩ. The input resistor is 9 times the output resistor, or 360 kΩ. (Figure 3-4). In the 752A, the input resistor is a group of three resistors, each with a nominal value of 3R, or 120 kΩ. The input resistance of the 10:1 divider is 400 kΩ.

3-13. In the 100:1 divider, the input resistor is 99R or 3.96 MΩ and the output resistor is 40 kΩ (Figure 3-5). The input resistance is 2 MΩohms rather than 4 MΩ ohms due to the driven guard circuit.

3-14. MODE SWITCH

3-15. The MODE switch determines the various internal and external connections for the precision divider, external reference standard, null detector, and the UUT in self-calibrate and operate modes. This is shown in Figure 2-3.

3-16. SELF-CALIBRATION CIRCUIT

3-17. The self-calibration circuit used in the 752A uses a technique based on the Wheatstone bridge to accurately and precisely set the ratios of the internal divider resistors. The switching necessary to perform self-calibration is supplied by the MODE switch.

3-18. The input resistor of each of the two voltage dividers is divided into three groups of values 3R or 30R. As shown in Figure 3-6, the CALIBRATE switch

connects the resistors in each group in series (OPERATE mode) or in parallel (CALIBRATE mode). In the CALIBRATE mode, the input resistors have a value of R or 10R allowing their values to be compared using a resistance bridge and an external null detector.

3-19. The Calibration Bridge is composed of two resistors of nominally equal value (120 kΩ). The polarity reversing positions of the CALIBRATE switch allow these two resistors to be electrically interchanged in their positions in the calibration bridge. Any value difference between the two calibration bridge resistors shows up on a null detector as a difference in the reading when the polarity switch is changed form '+' to'–'.

3-20. The BALANCE control allows the user to zero the difference between the calibration bridge resistor values. Note that the degree of balance between the calibrate and

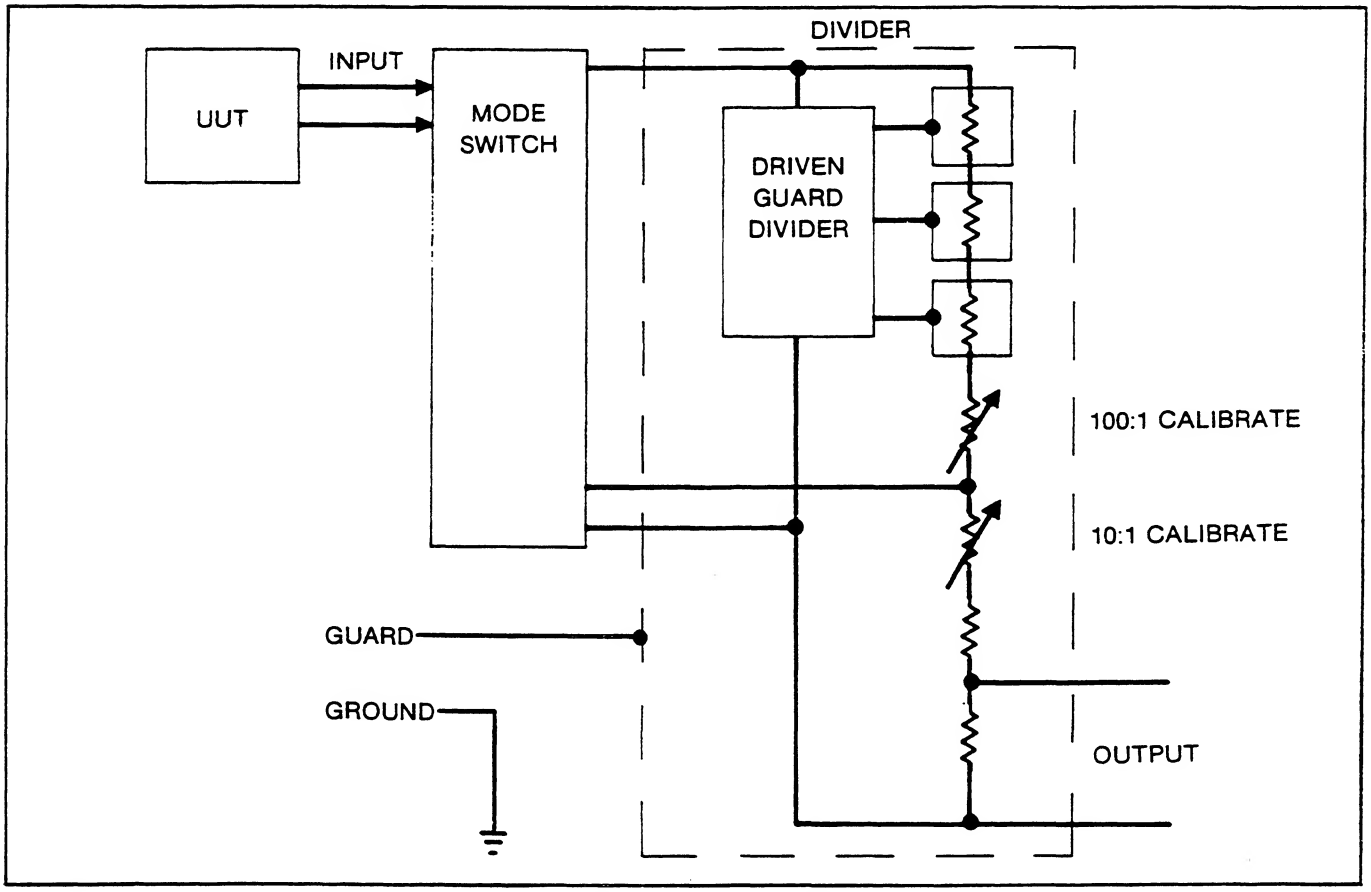


Figure 3-3. Stand-Alone Operation

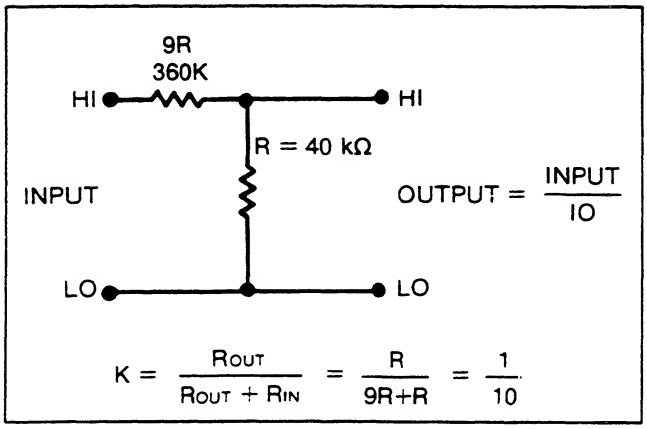


Figure 3-4. 10:1 Voltage Divider

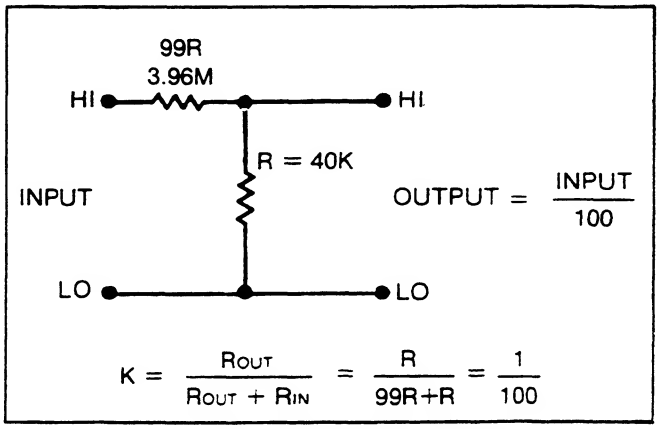


Figure 3-5. 100:1 Voltage Divider

unknown sides of the bridge does not degrade the ability to accurately match the two resistors in the calibration bridge in value.

3-21. The calibrate side of this bridge is adjusted such that both resistors are equal in value as described above. The bridge is then balanced by adjusting one of the 3R resistors in the 10:1 divider input resistor group for a null (Figure 3-7). The three parallel connected resistors are now equal to the output resistor. When the calibration switches are opened as shown in Figure 3-6, the resistance between the INPUT HI and OUTPUT HI terminals is exactly nine times the resistance between the OUTPUT HI and LO terminals.

3-22. The 100:1 Self-Calibration procedure is an extension of the 10:1 procedure. The calibration bridge is now used to compare the value of the entire 10:1 divider, previously calibrated, and the parallel configuration of the three 30R resistors in the 100:1 divider to the two equal value resistors of the calibration bridge (Figure 3-8). When the null detector indicates a null, the parallel resistor string is equal in value to the previously calibrated 10:1 divider.

NOTE

The 10:1 and 100:1 calibration controls are part of the 10:1 and 100:1 divider circuits regardless of the position of the MODE switch. Adjustment of either of these controls after self-calibration will result in out of specification performance.

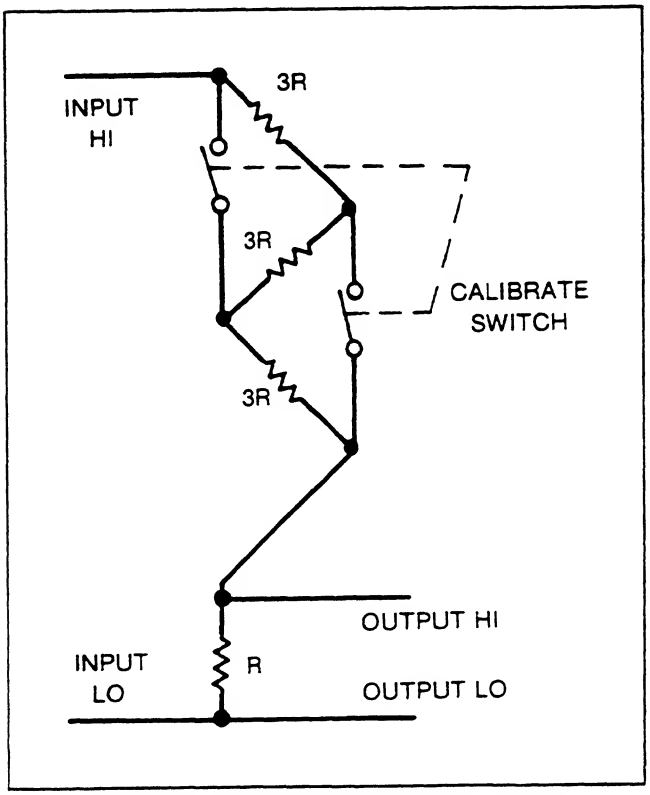


Figure 3-6. Calibrate Mode Switching (10:1)

3-23. GUARD CIRCUITS

3-24. The effects of leakage resistance can cause significant error in a 0.2 ppm precision divider. The 752A uses a driven guard circuit to reduce these effects on the resistor groups used in the 100:1 divider circuit (Figure 3-9). In addition, a passive guard circuit surrounds the entire resistor and switch network. Connection to the passive guard is made via the front panel GUARD terminal.

3-25. The driven guard operates from the input voltage applied to the 100:1 divider. The three groups of resistors comprising the 100:1 divider input resistor are enclosed in separate metal enclosures. The driven guard minimizes the effects of leakage by elevating the enclosure around a resistor group to a voltage equal to one-half of the voltage drop across that resistor group. This minimizes leakage effects by minimizing the potential difference between the resistor group and the nearest conductor.

3-26. ERROR ANALYSIS

3-27. The 752A functions as a very accurate voltage divider. Since it is not calibrated to an external traceable standard, a discussion of the sources of error is pertinent to the theory of operation. There are several major sources of error in the 752A. Fortunately, each of these sources has been addressed and controlled to within the necessary specifications. These sources are:

1. Switch contact resistance for switch contacts in series with the divider string.

2. Switch contact resistance for switch contacts involved in the series to parallel switching for self calibration.

3. Resistor mismatching errors

4. Errors in the Null Detector readings during self calibration.

5. Errors due to Temperature Coefficient of the resistors.

6. Leakage resistance in the materials used to fabricate the instrument (particularly the switches).

3-28. The error associated with switch contacts in series with the divider resistors shows up in the upper leg of the divider. The contact resistance adds to the resistance of the upper leg and its effect is shown in equation 3-1.

$$Vo/Vi=[1/\{N+(\Delta R/R)\}] \qquad (3\text{-}1)$$

where: N = ratio (e.g. 10:1 ratio, N=10)
R = output resistance
ΔR = switch contact resistance

3-29. The worst case occurs in the 10:1 divider where the output resistance is 40K ohms and the ratio is 10:1. In this

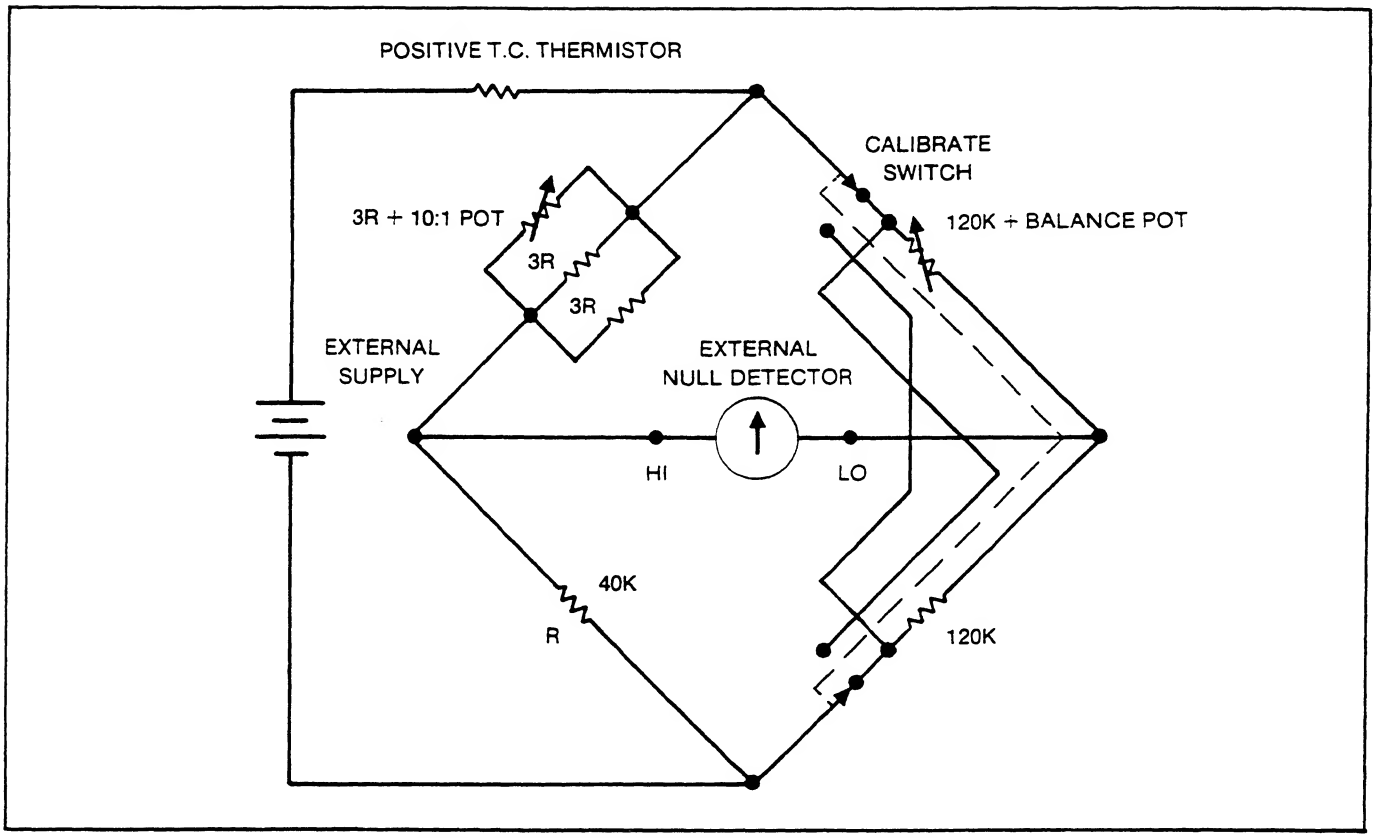


Figure 3-7. 10:1 Divider and Calibration Circuit

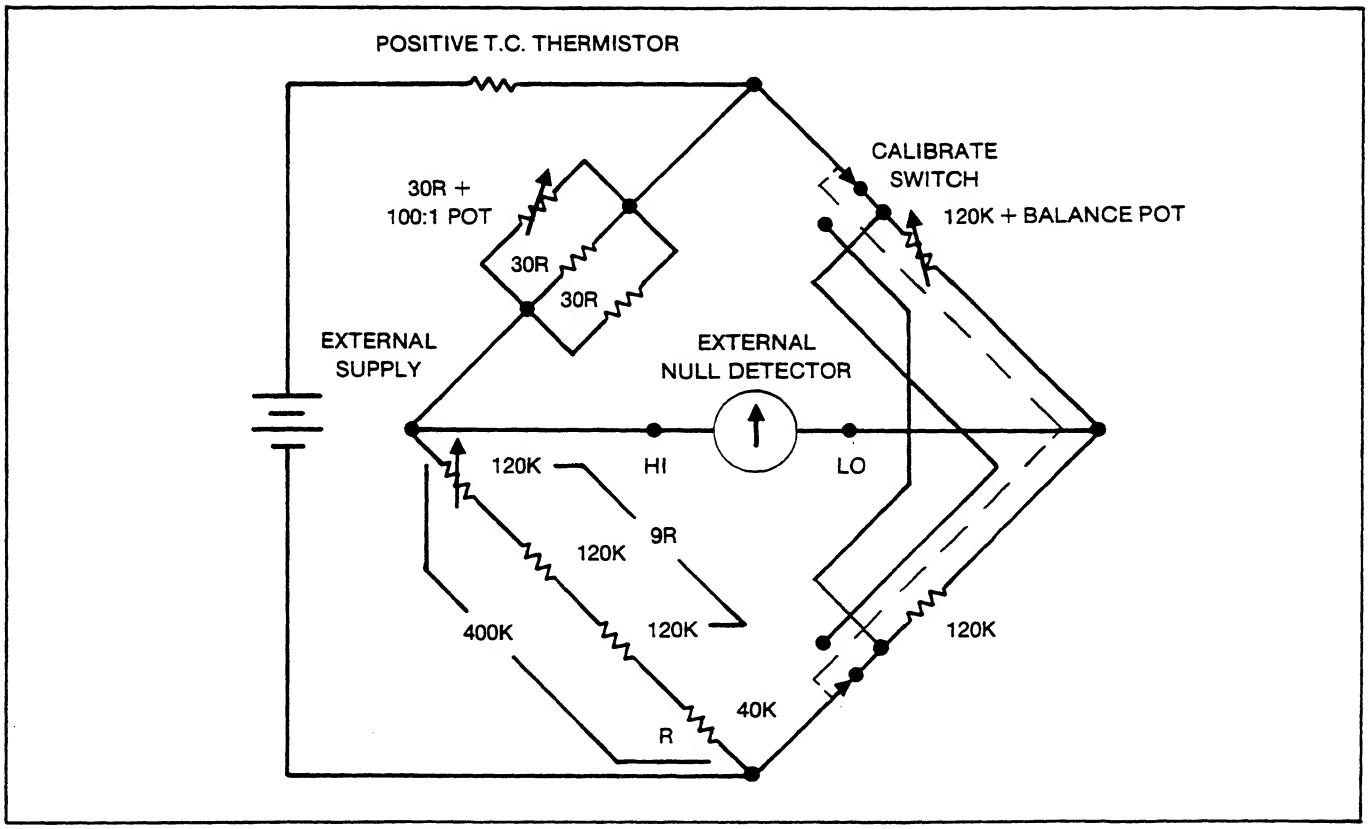


Figure 3-8. 100:1 Divider and Calibration Circuit

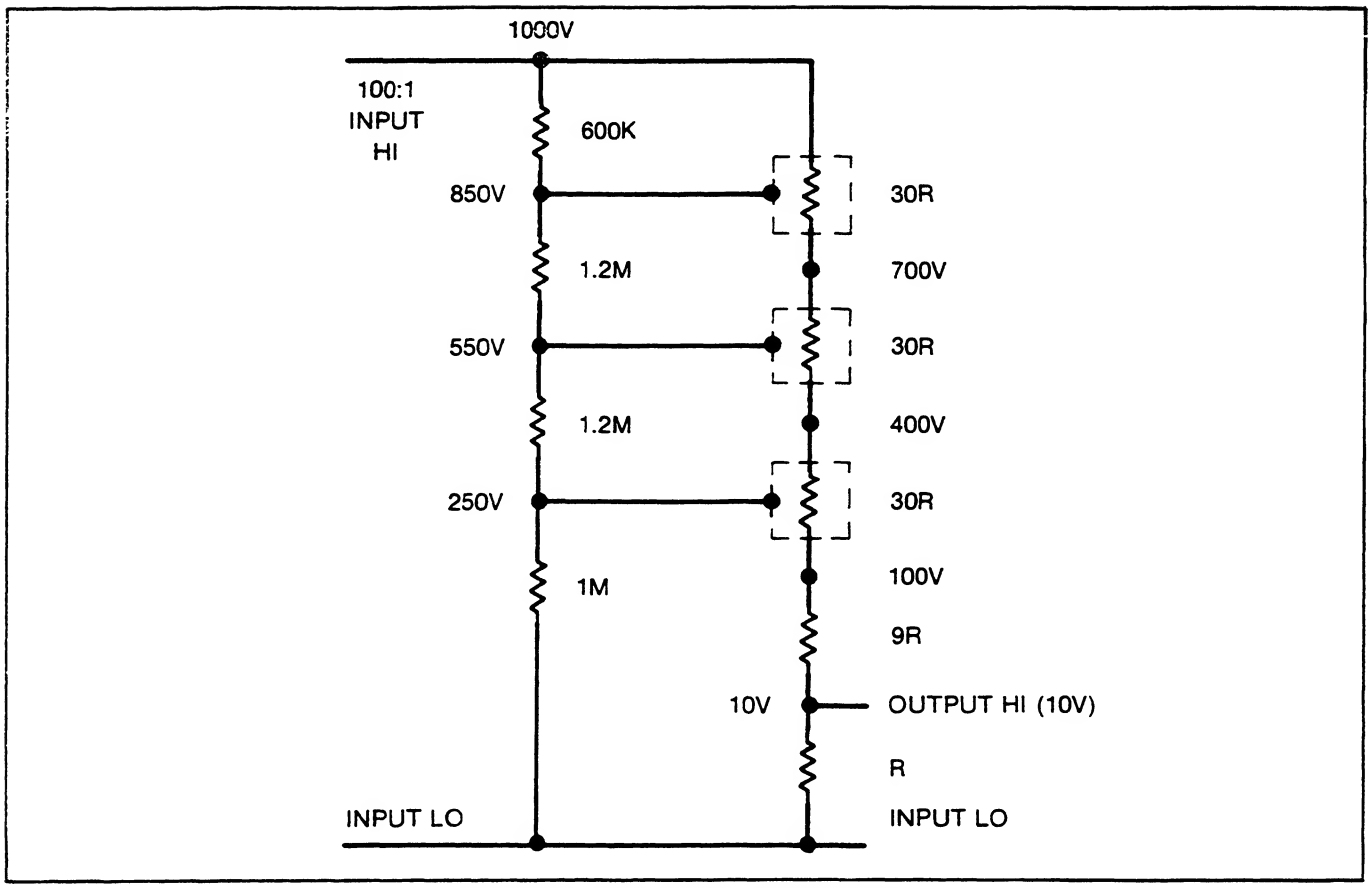


Figure 3-9. 100:1 Divider Driven Guard

case the error causes the output voltage to be lower than it should be by an amount ΔV_O, where ΔV_O = Ideal output voltage - Actual output voltage. The designed value for this switch resistance is less than 10 milliohms. Thus for the actual instrument the error associated with the series switch resistance is -0.025 ppm.

3-30. The output error associated with RS1 and RS2 switch contacts switching between the series configuration and the parallel configuration is somewhat more difficult to calculate (refer to Figure 3-10). The design of the instrument is such that most of the effects of this error are reduced by adjusting the interconnection resistances. Thus the worst case error due to these switch contacts is 0.042 ppm for the 10:1 and 0.044 ppm for the 100:1.

3-31. The error associated with resistor mismatches is negligible due to the close matching performed in the factory

3-32. The error due to the Null Detector readings depends upon the type and accuracy of the Null Detector used. The Null Detector used in design testing had an uncertainty of 0.2 uV. This error translates into an adjustment error of 0.04 ppm for both 10:1 and 100:1 ranges.

3-33. Errors in the divider ratio due to the temperature coefficient of the resistors has been limited to less than 0.05 ppm on the 10:1 ratio and to less than 0.3 ppm on the 100:1 ratio through the use of the Fluke Dynamic Resistor Matching technique.

3-34. Leakage resistance is the last source of error and perhaps the most important. The components most susceptible to these errors are the switches. For this reason, the switches have been cleaned and handled with care to reduce any surface contamination during production. Non Activated solder flux has been used to reduce the possibility of introducing ionic surface contaminants to the switch. A properly handled switch with proper solder connections will ensure that the ratio error due to leakage is less than 0.057 ppm on the 10:1 range and less than 0.38 ppm on the 100:1 range.

3-35. Using statistical summing techniques, the net errors are:

10:1 - Error less than 0.2 ppm
100:1 - Error less than 0.5 ppm

3-36. According to the values for each of the error sources, the net errors are within the specifications for the instrument.

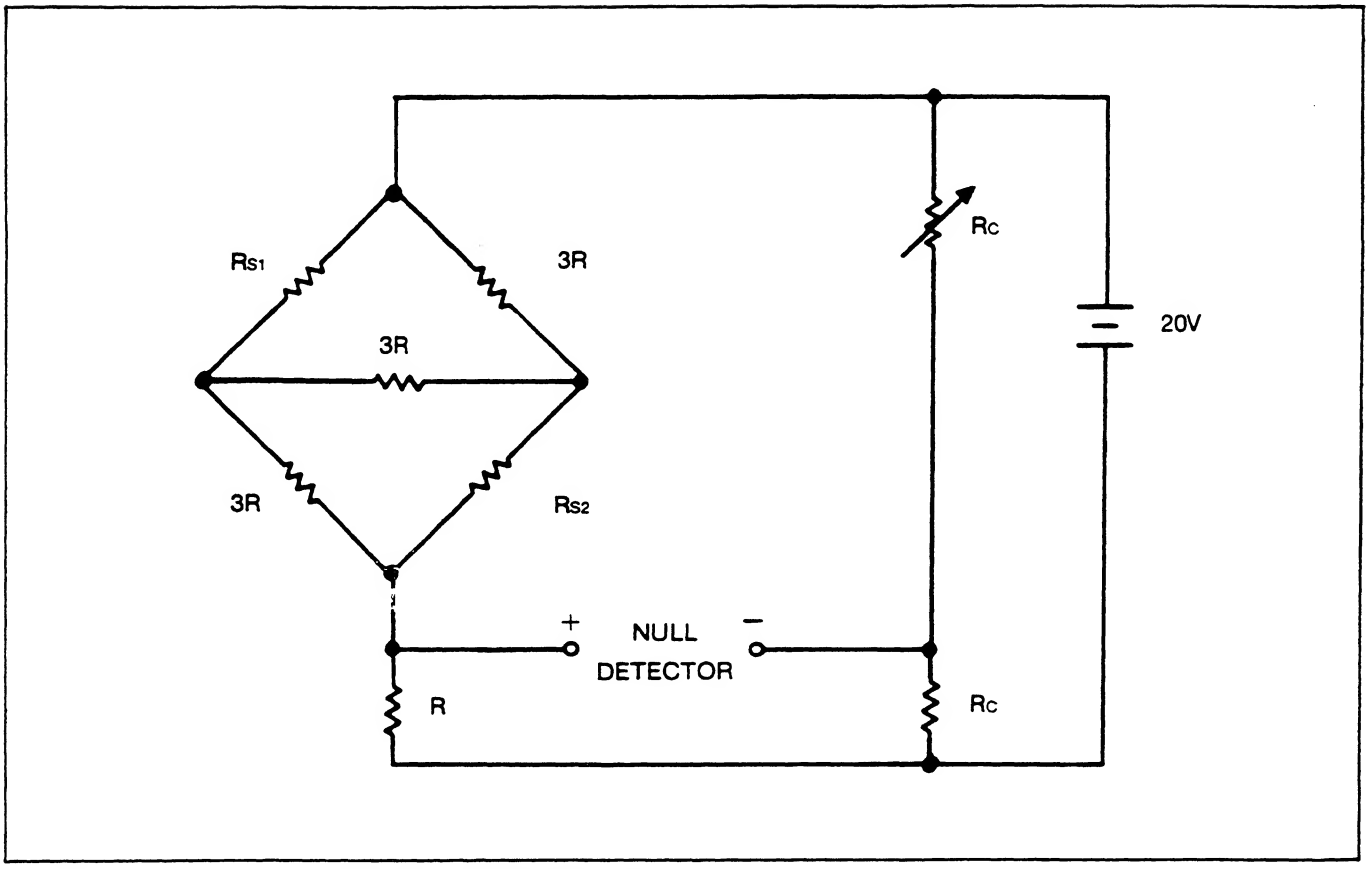


Figure 3-10. Simplified Schematic of 10:1 Calibration Circuit

Section 4
Maintenance

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRICAL SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

4-1. INTRODUCTION

4-2. The following paragraphs describe the calibration cycle requirements, manintenance procedures, performance checks, internal calibration, and troubleshooting for the 752A.

4-3. The 752A is self-calibrating, so it does not need to be included in a calibration cycle traceable to an external standard. An in-house calibration cycle is optional as the Self-Calibration Procedure will detect out-of-specification performance. The Internal Calibration Procedure provides a means of compensating for the long-term drift of the internal divider and calibration bridge resistors that cannot be compensated for in the Self-Calibration Procedure.

4-4. Self-Calibration and the resistance measurements described in the following section are recommended as an acceptance test when the instrument is first received. The equipment required for performance verification and calibration is shown in Table 4-1. Equivalent test equipment may be substituted providing it meets the minimum specification given in Table 4-1.

4-5. SERVICE INFORMATION

4-6. The 752A is warranted for a period of one (1) year upon delivery to the original purchaser. The WARRANTY is given on the back of the title page located in the front of this manual.

4-7. Factory authorized calibration and service for each Fluke product is available at various worldwide locations. A list of these service centers is located in Section 7 of this manual. Shipping information is given in Section 2 of this manual. If requested, an estimate will be provided to the customer before any repair work is begun on instruments that are beyond the warranty period.

Table 4-1. Test Equipment Required

TYPE	REQUIRED SPECIFICATIONS	RECOMMENDED MODEL
Null Detector	1 μV full-scale sensitivity 10 MΩ input resistance	Fluke 845AB/AR
Multimeter	4.5 digit display 200Ω to 2 MΩ resistance ranges, ±0.25% accuracy	Fluke 8050A, 8060A
Voltage Source	20V, 10 mA	Fluke 5440A
Cloth Gloves	Clean nylon or cotton	Fluke P/N 684720

4-8. The resistor modules (and the resistors therein) and the Bridge and Calibration PCB assembly are matched to each other during manufacture. The individual resistors are not replaceable separately. The resistor modules and Bridge and Calibration PCB assembly must be replaced as a set.

4-9. GENERAL MAINTENANCE

4-10. Introduction

4-11. The following paragraphs describe the general maintenance procedures for the 752A. These procedures should be completed only by qualified personnel.

4-12. Cleaning

CAUTION

TO PREVENT POSSIBLE DAMAGE TO THE FRONT PANEL, DO NOT USE AROMATIC HYDROCARBON OR CHLORINATED SOLVENTS ON THE FRONT PANEL OF THE 752A.

4-13. When the 752A is properly cared for and kept in a controlled atmosphere, cleaning is seldom required. Any contamination, particularly oil, in the instrument can contribute to an increase in leakage which may impair accuracy. Cleanliness of the switches is critical because low leakage resistance between switch contacts would shunt a part of the resistor string. This is also true of other internal wiring and, to a lesser extent, on the printed circuit assembly.

4-14. Clean the exterior and front panel with a soft cloth dampened in a mild solution of detergent and water.

CAUTION

TO INSURE CONTINUED PERFORMANCE WITHIN THE SPECIFICATIONS LISTED IN SECTION 1, USE EXTREME CAUTION WHEN CLEANING THE 752A. IN PARTICULAR, DO NOT USE COMPRESSED AIR TO REMOVE DUST FROM THE INSIDE OF THE INSTRUMENT. AVOID OIL CONTAMINATION OF THE INTERIOR OF THE INSTRUMENT. WEAR CLEAN CLOTH GLOVES (FLUKE P/N 684720 OR EQUIVALENT) WHEN WORKING INSIDE THE INSTRUMENT. DO NOT USE SPRAY CLEANERS ON THE SWITCHES OR POTENTIOMETERS INSIDE THE INSTRUMENT.

4-15. The switches used in the 752A are sealed units. They cannot be cleaned by 'normal' methods. Replace the switch(es) if it is determined that cleaning is necessary.

4-16. Internal Repair

4-17. When making wiring repairs or replacing a component, use 63/37 alloy, non-activated rosin core solder (Fluke P/N 961480 or equivalent) for all connections. Do not use a spray-type cleaner. If replacing a switch or other component, do not remove flux residue from the connection.

4-18. Access Procedure

4-19. Use the following procedures to disassemble the 752A for adjustment or repair.

CAUTION

TO INSURE CONTINUED INSTRUMENT PERFORMANCE TO THE SPECIFICATIONS LISTED IN SECTION 1 OF THIS MANUAL, DO NOT ALLOW THE INTERIOR OF THE INSTRUMENT TO ACCUMULATE DUST, OIL OR OTHER CONTAMINANTES WHILE OPEN FOR SERVICE. WEAR CLEAN CLOTH GLOVES WHILE SERVICING.

4-20. COVER REMOVAL

4-21. Use the following procedure to remove the top and bottom covers from the 752A. Refer to Figure 4-1.

1. Remove all screws securing the top and/or bottom cover(s).

2. Lift the cover(s) off the instrument.

4-22. Printed Circuit Board Jumper Access

4-23. Use the following procedure to access the printed circuit board jumpers. Refer to Figure 4-2.

1. Remove the top cover.

2. Remove the screws from the guard cover and remove it.

3. Remove the screws securing the service cover and remove it.

4. The jumpers on the printed circuit board are now accessible for servicing.

4-24. PRINTED CIRCUIT ASSEMBLY REMOVAL

4-25. Use the following procedure to remove the printed circuit board from the 752A. Refer to Figure 4-3.

1. Remove both covers and the guard cover.

2. Remove the screws securing the rear bulkhead located near the rear of the 752A and slide to the rear of the instrument.

3. Slide the entire circuit board assembly towards the rear of the instrument, until the retaining tabs are clear of the plastic card holders.

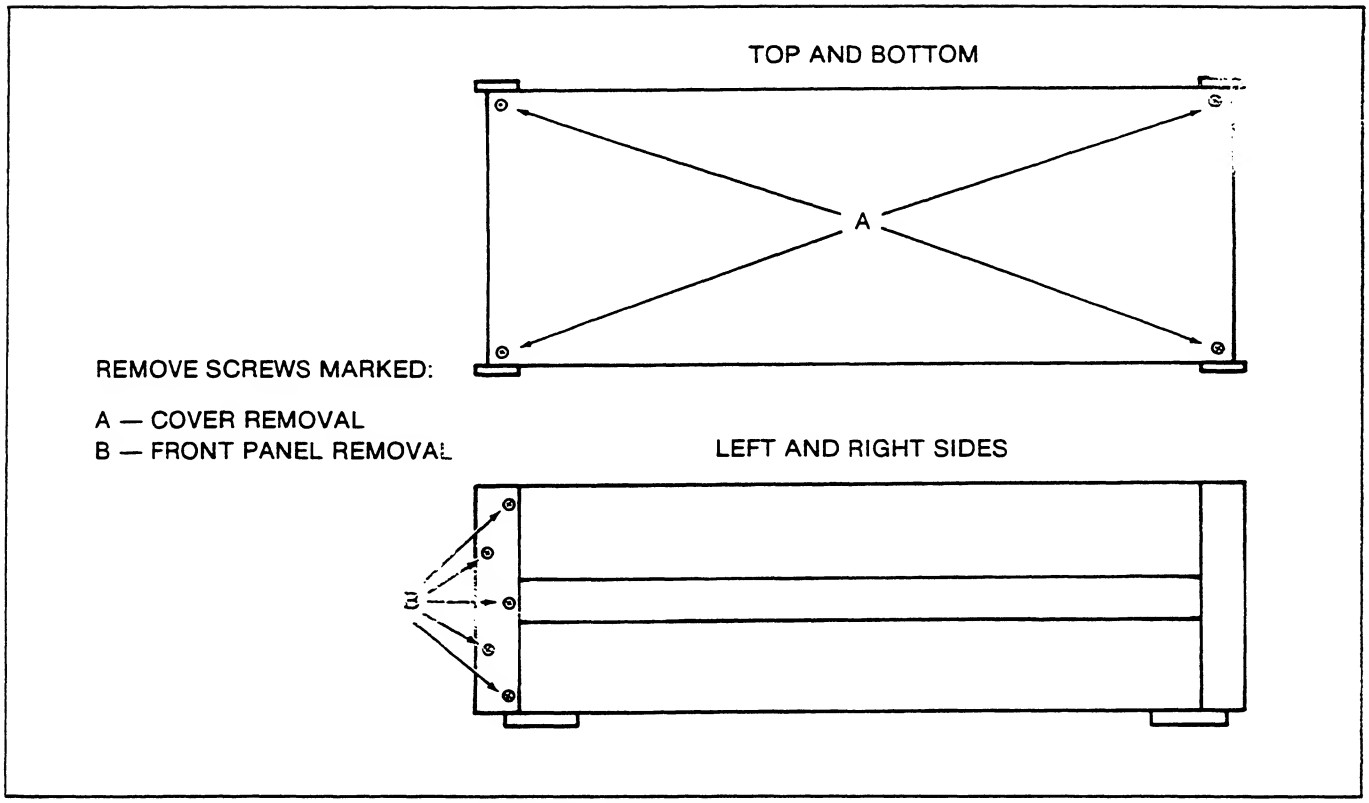


Figure 4-1. Cover Screw Locations

4. Remove the assembly by pushing the side corresponding to the wire harness exit down, to clear the card holders and lifting the opposite side up, to clear the card holders. Lift the assembly clear of the chassis.

CAUTION

DO NOT STRESS OR EXCESSIVELY BEND THE WIRE HARNESS CONNECTED TO THE PRINTED CIRCUIT BOARD ASSEMBLY. THE WIRES USE SOLID CONDUCTORS AND BREAK EASILY.

5. Remove screws securing the service cover housing and lift the housing clear.

6. Remove the screws securing the printed circuit board.

7. The printed circuit board is now accessible.

4-26. RESISTOR MODULE REMOVAL

4-27. Use the following procedure to remove the resistor modules from 752A Refer to Figure 4-4.

1. Remove both covers and the guard cover.

2. Remove the entire printed circuit board assembly. Fold the assembly towards the front of the 752A.

3. Slide the rear resistor module towards the rear of the instrument, until the cover tabs clear the plastic card holders, then lift up and out.

4. To access the front resistor modules, remove both rear modules and the center bulkhead. Remove the front modules as described in step 3 of this procedure.

4-28. FRONT PANEL REMOVAL

4-29. Use the following procedure to detach the front panel from the 752A:

1. Remove the top and bottom covers.

2. Peel the decal from each of the front moldings, and remove the exposed screws. Remove the molding.

3. Remove the knobs from the three calibrate pots. When removing the knobs, be careful not to lose the springs and washers located under the knobs.

4. Remove the knobs from the MODE and CALIBRATE switches.

5. Pull the front panel free from the chassis.

6. Remove the screws securing the front panel sub-chassis. The sub-chassis will now fold down flat against the table top.

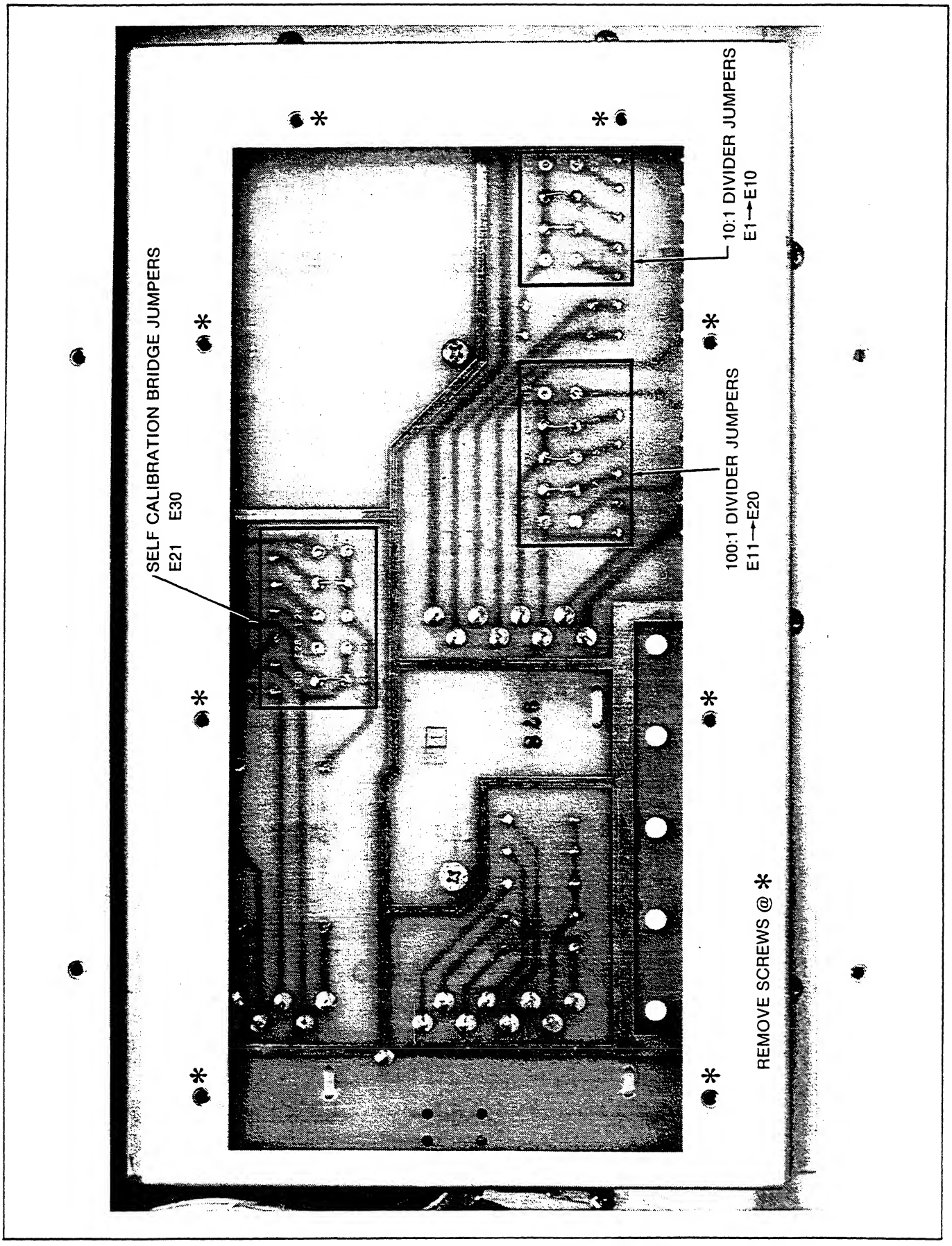
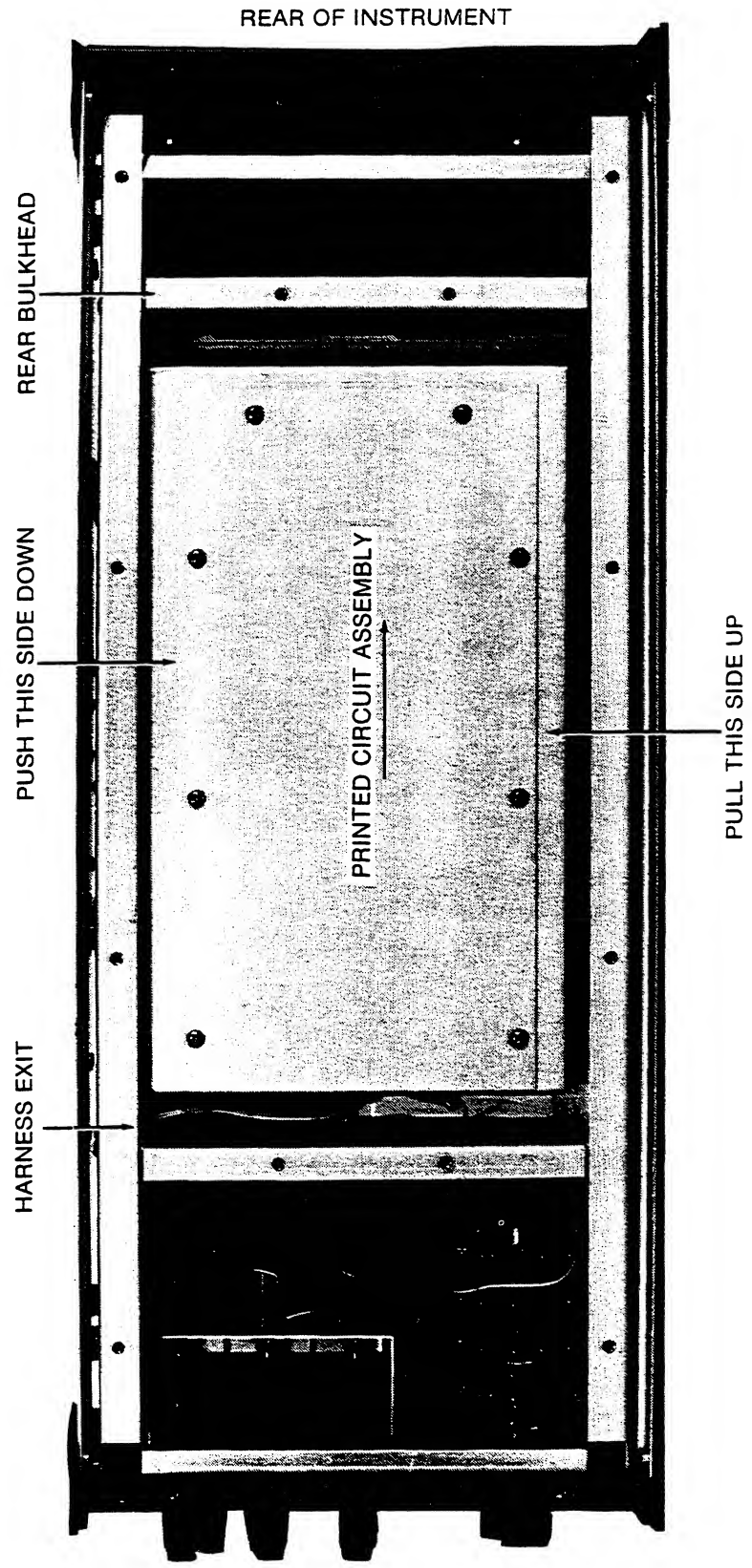


Figure 4-2. Printed Circuit Board Jumper Access



1. Remove screws attaching rear bulkhead to chassis bottom.
2. Slide the printed circuit assembly in the direction of the arrow towards the rear of instrument to clear the plastic card guides.
3. Push down where indicated, while pulling up where indicated to clear the assembly from the card guides and chassis.

Figure 4-3. PCB Access

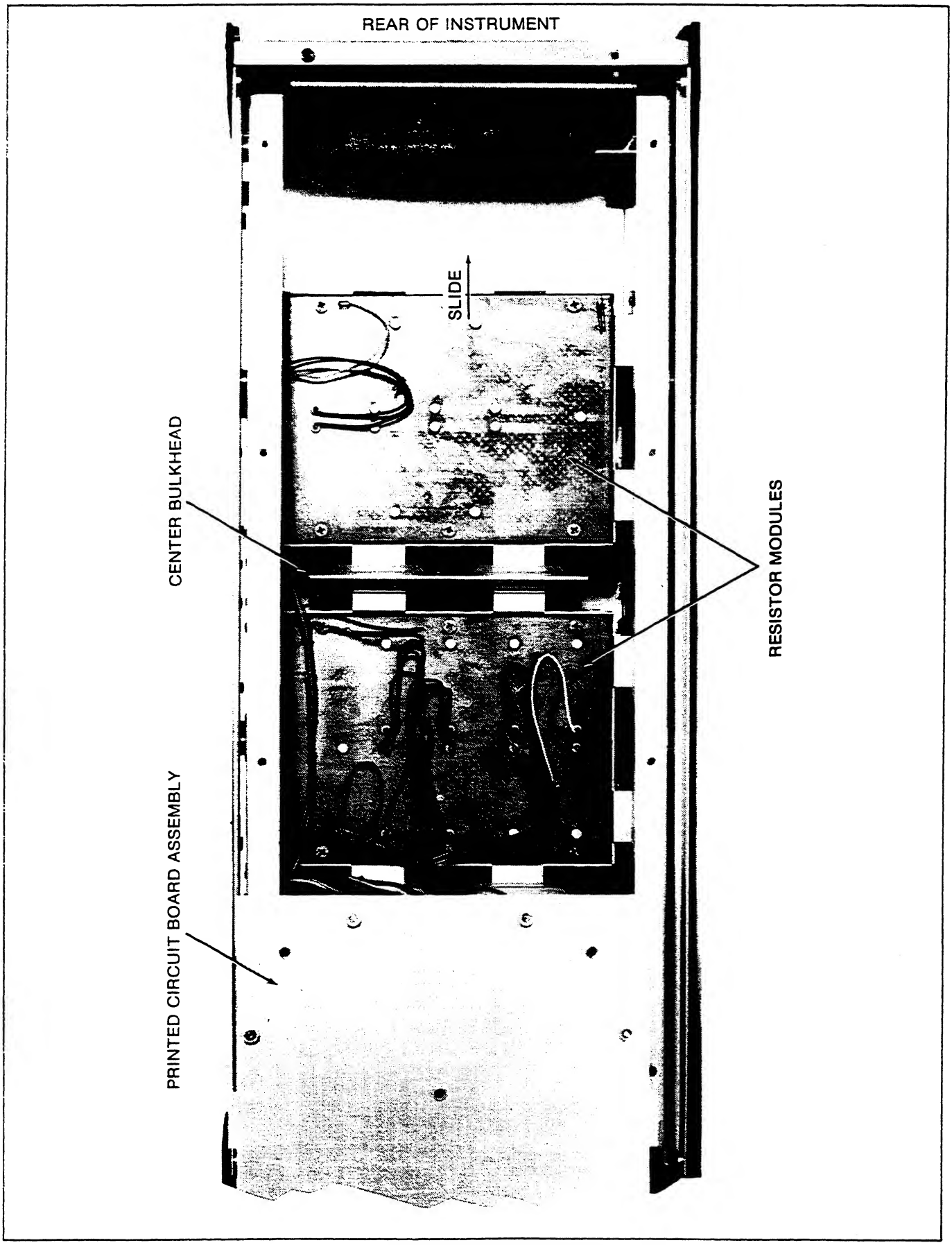


Figure 4-4. Resistor Module Access

4-30. PERFORMANCE CHECKS

4-31. Front panel resistance measurements and self-calibration are recommended as a means of verifying the specifications listed Section 1. The various front panel resistances are listed in this section under Troubleshooting. The Self-Calibration procedure described in Section 2 checks all internal resistor networks against each other.

4-32. INTERNAL CALIBRATION (Long-Term Drift Correction)

4-33. The Self-Calibration Procedure compensates for normal day to day drift of the voltage divider and bridge resistor networks. Over extended periods of time, it is possible for the values of the resistor networks to drift beyond the capabilities of the Self-Calibration potentiometers. Perform the appropriate calibration procedure when either of the following occur:

1. It is not possible to achieve equal readings on the Null Detector between the + and - positions of the CALIBRATE switch. Use the Self-Calibration Bridge Long-Term Drift Correction Procedure to correct this condition.

2. It is not possible to obtain an acceptable Null Detector reading using the 10:1 or 100:1 pots after obtaining equal Null Detector readings on the + and - CALIBRATE switch positions. Perform the drift correction procedure on the appropriate divider.

4-34. Self-Calibration Bridge Long-Term Correction Procedure

4-35. Use this procedure when it is impossible to achieve equal readings on the Null Detector between the + and - positions of the CALIBRATE switch.

1. Perform the 10:1 Self-Calibration procedure (steps 1 through 13) in Section 2. Minimize the Vd term in the following expression such that the Calibrate pot is at one end of its rotation:

$Vd = -(Dp-Dm)/2$

where: Vd = Corrected Null Detector deflection

Dp = Null Detector deflection in μV in the 10:1+ switch position

Dm = Null Detector deflection in μV in 10:1- switch position

2. Note the value of Vd.

3. Place the CALIBRATE switch to the 10:1+ position.

4. Algebraically add the value of Vd obtained during the Self-Calibration procedure to one-half of the value of the pot window (292 μV). The pot window is defined as the total adjustment range of the potentiometer, as seen at the Null Detector terminals.

$V = (Vp/2) + |Vd|$

where: V = correction voltage

Vp = pot window Voltage (292 μV)

|Vd| = absolute value of corrected Null Detector deflection

5. Apply the following formula to find the amount of correction needed.

$\Delta Rp = k(0.024)(V)$

where: V = correction voltage in uV

k = -1 if Vd<0

k = 1 if Vd>0

ΔRp = change in resistance in ohms

6. Dissassemble the 752A and inspect the Bridge and Compensation PCB assembly. Determine the status of jumpers E21 through E30 inclusive. The jumper locations are shown in Figure 4-3. Use Table 4-2 to find the present compensation value (Rc).

7. Add Rc to Δ Rp to find the new compensation value (Rc').

8. Use Table 4-2 to find the new jumper configuration. Select the closest value in Table 4-2. Reinstall the jumpers per Table 4-2 and Rc'.

9. Reassemble the instrument.

4-36. Self-Calibration Bridge Long-Term Drift Correction Example

4-37. While performing the Self-Calibration procedure, the BALANCE control cannot be adjusted for equal Null Detector readings between the + and - settings of the CALIBRATE switch. The closest possible readings are +15 μV at the + setting and -5 μV at the - setting, with the BALANCE control set a one extreme.

4-38. The adjustment window for the 10:1 CALIBRATE pot has drifted outside of the range of the control. The adjustment window must be shifted 10 uV in

the opposite direction plus one-half of the value of the pot window. Thus:

$$Vd = -[(Dp-Dm)/2]$$
$$= -[15-(-5)]/2$$
$$= -10\ \mu V$$

and

$$V = Vp/2 + |Vd|$$
$$= 292/2 + -10$$
$$= 156\ \mu V$$

Solving for ΔRp

$$\Delta Rp = k(0.024)(V) \qquad Vd<0 ,\Rightarrow k=(-1)$$
$$= -(0.024)(156)$$
$$= -3.744$$

After inspecting jumpers E21 through E30, the present jumper configuration using Table 4-2 is:

00101 = 10 ohms

Adding ΔRp to this value:

10 - 3.744 = 6.256 ohms

Looking at Table 4-2, the nearest possible values are:

01101 = 5 ohms

00101 = 10 ohms

Interpolation gives 01101 = 5 ohms as the best choice. The new jumper configuration is:

Jumper	Condition
E21-E22	Open
E23-E24	Short
E25-E26	Short
E27-E28	Open
E29-E30	Short

The necessary correction is to add jumpers at E23-E24. This new configuration gives a shift of:

$$\Delta Rp = 10 - 5$$
$$= +5 \text{ ohms}$$

and

$$D = (41.7)(+5)$$
$$= +208.5\ \mu V$$

This shift is sufficient to move the pot window as close to its centered position as possible.

4-39. 10:1 Divider Long-Term Drift Correction Procedure

4-40. Use the following procedure when the best possible null on the Null Detector exceeds the stated limits at completion of the 10:1 Self-Calibration procedure and there is no differnece between the 10:1+ and 10:1- CALIBRATE switch readings on the Null Detector.

Table 4-2. Self-Calibration Bridge Drift Correction Network

JUMPERS					NET RESISTANCE
E21 to E22	E23 to E24	E25 to E26	E27 to E28	E29 to E30	Rc (ohms)
1	0	0	0	1	0
0	1	1	0	1	5
0	1	0	0	1	10
0	0	1	0	1	10
1	0	0	1	0	15
0	1	1	1	0	20
0	1	0	1	0	25
0	0	1	1	0	25

1 = jumper installed
0 = no jumper

1. Perform the Self-Calibration procedure and set the 10:1 calibrate pot for the best possible null. Note this value in μV.

2. Algebraically add the Null Detector reading obtained during the Self-Calibration procedure to one-half of the value of the Pot Window (83 μV). Let this sum equal V.

$V = (Vp/2)+Vn$

where:

V = correction voltage in μV

Vp = Pot Window Voltage (83 μV)

Vn = Null Detector reading in μV.

3. Apply the following formula to find the amount of correction needed.

$\Delta Rp = (0.072)(V)$

where:

V = correction voltage in μV

ΔRp = change in resistance in ohms

4. Remove the top cover, guard cover, and service cover. Inspect the Bridge and Compensation PCB assembly to determine the status of jumpers E1 through E10 inclusive. The jumper locations are shown in Figure 4-3. Use Table 4-3 to find the present compensation value (Rc).

5. Add Rc to ΔRp to find the new compensation value (Rc').

6. Use Table 4-3 to find the new jumper configuration. Select the closest value in Table 4-3. Reinstall the jumpers per Table 4-3 and Rc'.

7. Perform the Self-Calibration Procedure described in Section 2 of this manual.

8. Reassemble the instrument.

4-41. 10:1 Divider Drift Correction Example

4-42. In this example, assume that after performing the Self-Calibration Procedure, the 10:1 divider can not be satisfactorily nulled. The closest possible null is 20 uV with the 10:1 CALIBRATE pot turned to its extreme.

4-43. The adjustment window for the 10:1 CALIBRATE pot has drifted outside of the range of the control. The adjustment window must be shifted 20 uV in the opposite direction plus one-half of the value of the pot window. Thus:

$V = (83/2) + 20$

$= 61.5\ \mu V$

and

$\Delta Rp = (0.072)(61.5)$

$= 4.43$ ohms

After inspecting jumpers E1 through E10, the present jumper configuration using Table 4-3 is:

01010 or 38.710 ohms.

Adding ΔRp to this value:

$38.710 + (4.43) = 43.14$ ohms

Looking at Table 4-3, the nearest possible values are:

00100 = 43.796 ohms

00101 = 42.857 ohms

Interpolation gives 00101 (42.857 ohms) as the best choice.

The new jumper configuration is:

Jumper	Condition
E9-E10	open
E7-E8	open
E5-E6	short
E3-E4	open
E1-E2	short

The necessary correction is to remove the jumpers from E3 to E4 and E7 to E8. Then add jumpers from E1 to E2 and E5 to E6.

$\Delta Rp = 42.857 - 38.710$

$= 4.147$ ohms

and

$D = (-13.89)(4.150)$ where: D = shift in window in μV.

$= -57.16\ \mu V$.

Table 4-3. 10:1 Divider Drift Correction Network

JUMPERS					NET RESISTANCE
E9 to E10	E7 to E8	E5 to E6	E3 to E4	E1 to E2	Rc
0	0	0	0	0	48.000
0	0	0	0	1	46.875
0	0	0	1	0	45.802
0	0	0	1	1	44.776
0	0	1	0	0	43.796
0	0	1	0	1	42.857
0	0	1	1	0	41.958
0	0	1	1	1	41.096
0	1	0	0	0	40.268
0	1	0	0	1	39.474
0	1	0	1	0	38.710
0	1	0	1	1	37.975
0	1	1	0	0	37.267
0	1	1	0	1	36.585
0	1	1	1	0	35.928
0	1	1	1	1	35.294
1	0	0	0	0	34.682
1	0	0	0	1	34.091
1	0	0	1	0	33.520
1	0	0	1	1	32.967
1	0	1	0	0	32.432
1	0	1	0	1	31.915
1	0	1	1	0	31.414
1	0	1	1	1	30.928
1	1	0	0	0	30.457
1	1	0	0	1	30.000
1	1	0	1	0	29.557
1	1	0	1	1	29.126
1	1	1	0	0	28.708
1	1	1	0	1	28.302
1	1	1	1	0	27.907
1	1	1	1	1	27.523

1 = jumper installed
0 = no jumper

4-44. 100:1 Divider Long-Term Drift Correction Procedure

4-45. Use this procedure when the residual reading on the Null Detector exceeds the stated limits at completion of the 100:1 Self-Calibration Procedure. It is assumed that the 10:1 Self-Calibration procedure has been performed satisfactorily. The methods used in the preceding example may also be used here, the only exceptions being the substitution of Table 4-4 for Table 4-3 and substitution of the correct value of the pot window.

1. Perform the 100:1 Self-Calibration Procedure and set the 100:1 calibrate pot for the best possible null. Note this value in μV.

2. Algebraically add the Null Detector reading obtained during the Self-Calibration Procedure to

one-half of the value of the pot window. Let this sum equal V.

$V = (Vp/2)+Vn$

where: V = Correction Voltage

Vp = Pot Window Voltage
143 μV

Vn = Null Detector Reading

3. Apply the following formula to find the amount of correction needed.

$\Delta Rp = (0.72)(V)$

4. Remove the top cover, guard cover and service cover from the 752A as described in the Access Procedure section of this manual. Inspect the Bridge and Compensation PCB assembly to determine the status of jumpers E11 through E20, inclusive. The jumper locations are shown in Figure 4-3. Use Table 4-4 to find the present compensation value (Rc).

5. Add Rc to ΔRp to find the new compensation value (Rc'). Select the closest value from Table 4-4.

6. Use Table 4-4 to find the new jumper configuration. Reinstall the jumpers per Table 4-4 and Rc'.

7. Perform the Self-Calibration Procedure described in Section 2 of this manual.

8. Reassemble the instrument.

4-46. TROUBLESHOOTING

4-47. The physical construction of the 752A lends itself to ease of troubleshooting. Use the resistance ranges of the Multimeter to isolate gross defects to within a module. Use the resistance ranges of the Multimeter on the various combinations of front panel terminals to isolate switching problems. Some of the correct resistance values are listed in Table 4-5. Inspect the internal wiring and solder connections. Proper soldering with non-activated flux solder (Fluke P/N 961480 or equivalent) and low wiring resistance are critical in this instrument.

Table 4-4. 100:1 Divider Drift Correction Network

JUMPERS					NET RESISTANCE
E11 to E12	E13 to E14	E15 to E16	E17 to E18	E19 to E20	Rc (ohms)
1	0	0	0	1	0
0	1	1	0	1	30
0	1	0	0	1	60
0	0	1	0	1	60
1	0	0	1	0	90
0	1	1	1	0	120
0	1	0	1	0	150
0	0	1	1	0	150

1 = jumper installed

0 = no jumper

Table 4-5. Front Panel Resistance Measurements

FROM	TO	CAL SWITCH	MODE SWITCH	RESISTANCE VALUE (Ω)
INPUT HI	INPUT LO	OPR	10:1	380K
INPUT HI	INPUT LO	OPR	100:1	2M
REFERENCE STANDARD HI	REFERENCE STANDARD LO	OPR	1V	380K
REFERENCE STANDARD HI	REFERENCE STANDARD LO	OPR	0.01V	2M
REFERENCE STANDARD HI	NULL DETECTOR LO	OPR	10V	0
INPUT HI	NULL DETECTOR HI	OPR	10V	0
INPUT HI	INPUT LO	10:1+	CAL	61K
INPUT HI	INPUT LO	10:1—	CAL	61K
INPUT HI	INPUT LO	100:1+	CAL	177.5K
INPUT HI	INPUT LO	100+1—	CAL	177.5K
INPUT HI	NULL DETECTOR LO	10:1+	752CAL	76K
INPUT HI	NULL DETECTOR LO	10:1—	752CAL	76K
INPUT HI	NULL DETECTOR LO	100:1+	752CAL	107K
INPUT HI	NULL DETECTOR LO	100:1—	752CAL	107K

Section 5
List of Replaceable Parts

TABLE OF CONTENTS

INTRODUCTION

This section contains the parts list of the 752A Reference Divider. Components are listed alphanumerically.

Parts lists include the following information:

1. Reference Designation.
2. Description of each Part.
3. FLUKE Stock Number.
4. Federal Supply Code for Manufacturers.
5. Manufacturer's Part Number.
6. Total Quantity of Components Per Assembly.

Although Fluke recommends module exchange in place of component-level repair, this manual also includes schematics and a discussion of the theory of operation. Service by non-factory personnel voids the warranty. Use of parts not approved by Fluke may compromise board specifications and operation.

HOW TO OBTAIN PARTS

Components may be ordered directly from the John Fluke Mfg. Co., Inc. or its authorized representative by using the Fluke Stock Number or from the manufacturer by using the manufacturer's part number.

In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

To ensure prompt handling of your order, include the following information:

1. Quantity.
2. Fluke Stock Number.
3. Description.
4. Reference Designation.
5. Printed Circuit Board Part Number and Revision Letter.

Parts price information is available from the John Fluke Mfg. Co., Inc. or from its representatives.

Table 5-1. 752A Final Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
	FINAL ASSEMBLY 752A FIGURE 5-1 (752A-T&B)						
A1	RESISTOR MODULES, MATCHED ASSEMBLY	Module Exchange Recommended			1		
E1-E4	BINDING POST ASSEMBLY, RED	637892	89536	637892	4		
E5-E8	BINDING POST ASSEMBLY, BLACK	637900	89536	637900	4		
E9	BINDING POST ASSEMBLY, BLUE	637876	89536	637876	1		
E10	BINDING POST ASSEMBLY, GREEN	637868	89536	637868	1		
E11	BINDING POST, GROUNDING	102707	20584	1444	1		
E12	BINDING POST, KNURLED	102889	20584	1445	1		
E13	LUG, SOLDER	101501	79963	327	1		
H1	SPRING, TENSION	163170	89536	163170	4		
H2	WASHER, FLAT, NYLON	682385	89536	682385	5		
H3	WASHER, FLAT, SS, 0.254 ID	649772	86928	5710-299-10	6		
H4	SCREW, PHP, 6-32 X 1/4	152140	89536	152140	10		
H5	SCREW, FHP, 8-32 X 1/2	114355	89536	114355	2		
H6	WASHER, FLAT, SS, 0.254 ID	649772	86928	5710-299-10	6		
H7	NUT, NYLON, PUSH-IN	222414	83058	PC-97726	16		
H8	NUT, HEX, 1/4-28	110619	89536	110619	1		
H9	WASHER, FLAT	312538	89536	312538	1		
H10	WASHER, SPLIT LOCK, 1/4	111518	89536	111518	1		
H11	SCREW, PHP, 6-32 X 1/4	152140	89536	152140	8		
H12	SCREW, RHP, 8-32 X 5/8	114983	89536	114983	4		
H13	SCREW, FHP, 8-32 X 5/16	281725	89536	281725	8		
H14	SCREW, FHP, 8-32 X 7/16	306159	89536	306159	12		
H15	SCREW, PHP, THD/FORM, 8-32 X 1/2	306233	89536	306233	16		
H16	SCREW, PHP, 6-32 X 1/4	152140	89536	152140	18		
H17	SCREW, PHP, 6-32 X 1/2	152173	89536	152173	4		
H18	SCREW, FHP, UNDERCUT, 6-32 X 1/4	320093	89536	320093	4		
H19	SCREW, FHP, 6-32 X 1/4	320093	89536	320093	4		
H20	SCREW, PHP, 6-32 X 1/4	152140	89536	152140	16		
MP1	FRONT PANEL	645077	89536	645077	1		
MP2	BUSHING, NYLON	339978	89536	339978	2		
MP3	BULKHEAD, FRONT	645143	89536	645143	1		
MP4	CLUTCH, VARIABLE RESISTOR	645655	89536	645655	6		
MP5	SHAFT, VARIABLE RESISTOR	645663	89536	645633	3		
MP6	BRACKET, VARIABLE RESISTOR	645671	89536	645671	1		
MP7	ISOLATOR, SWITCH	645648	89536	645648	1		
MP8	EXTENSION, SHAFT INSULATOR	645044	89536	645044	2		
MP9	BUSHING, PANEL	649756	89536	649756	3		
MP10	RING, RETAINING	168922	89536	168922	3		
MP11	REAR PANEL	645085	89536	645085	1		
MP12	CHASSIS, SIDE	645101	89536	645101	2		
MP13	CHASSIS, GUARD	645135	89536	645135	1		
MP14	BULKHEAD, CENTER	645150	89536	645150	1		
MP15	TRIM, SIDE	642298	89536	642298	2		
MP16	INSERT, SIDE TRIM	642306	89536	642306	1		
MP17	HANDLE	642314	89536	642314	1		
MP18	STRAP, HANDLE	644880	89536	644880	1		

Table 5-1. 752A Final Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO.	TOT QTY	REC QTY	NOTE
MP19	ADHESIVE, SIDE TRIM	680850	89536	680850	2		
MP20	HANDLE RETAINER	579052	89536	579052	2		
MP21	BRACKET, HANDLE SUPPORT	632414	89536	632414	2		
MP22	INSULATOR, CHASSIS	644906	89536	644906	4		
MP23	SPRING, COIL, SS	649764	83553	C0300-022-0690S	3		
MP24	CORNER ANGLE BRACKET	298166	89536	298166	2		
MP25	NAMEPLATE, SERIAL	472795	89536	472795	1		
MP26	CORNER, PLASTIC	656231	89536	656231	4		
MP27	FOOT, REAR PANEL	657064	89536	657064	4		
MP28	KNOB, KNURLED, DARK PEWTER	683805	89536	683805	3		
MP29	KNOB, POINTER, DARK PEWTER	683813	89536	683813	2		
MP30	CLAMP, CABLE	172080	89536	172080	5		
MP31	BOTTOM COVER	645127	89536	645127	1		
MP32	BULKHEAD, REAR	645168	89536	645168	1		
MP33	PARTITION, MODULE	645630	89536	645630	1		
MP34	MODULE COVER, LARGE	645531	89536	645531	1		
MP35	FOOT, SINGLE BAIL TYPE (DARK UMBER)	653923	89536	653923	4		
MP36	BAIL INSTRUMENT	605931	89536	605931	2		
MP37	TOP, COVER	645119	89536	645119	1		
MP38	GUARD, COVER	645176	89536	645176	1		
MP39	ACCESS PLATE, MODULE	645549	89536	645549	1		
MP40	DECAL, FRONT CORNER	659235	89536	659235	2		
MP41	DECAL, REAR CORNER	685206	89536	685206	2		
MP42	MODULE SERVICE KIT (not shown)	644872	89536	644872	AR		
MP43	NON-ACTIVATED FLUX SOLDER (not shown)	961480	89536	961480	AR		
R55	RES, VAR, 200 +/-3%, 2W	542928	80294	3500-2-201	3		
R455	RES, VAR, 200 +/-3%, 2W	542928	80294	3500-2-201	REF		
R555	RES, VAR, 200 +/-3%, 2W	542928	80294	3500-2-201	REF		
RT1	THERMISTOR, 1K +/-40%	494740	50157	180Q10215	1		
S1	SWITCH ASSEMBLY, MODE	644963	89536	644963	1		
S2	SWITCH ASSEMBLY, CALIBRATE	644971	89536	644971	1		
TM1	INSTRUCTION MANUAL, 752A	645069	89536	645069	1		
W1	WIRE, SILVER PLATED, #18 AWG (not shown)	203059	89536	203059	A/R		
W2	WIRE, BUS, #22 AWG	115469	89536	115469	AR		
W3	HARNESS ASSEMBLY	650986	89536	650986	1		

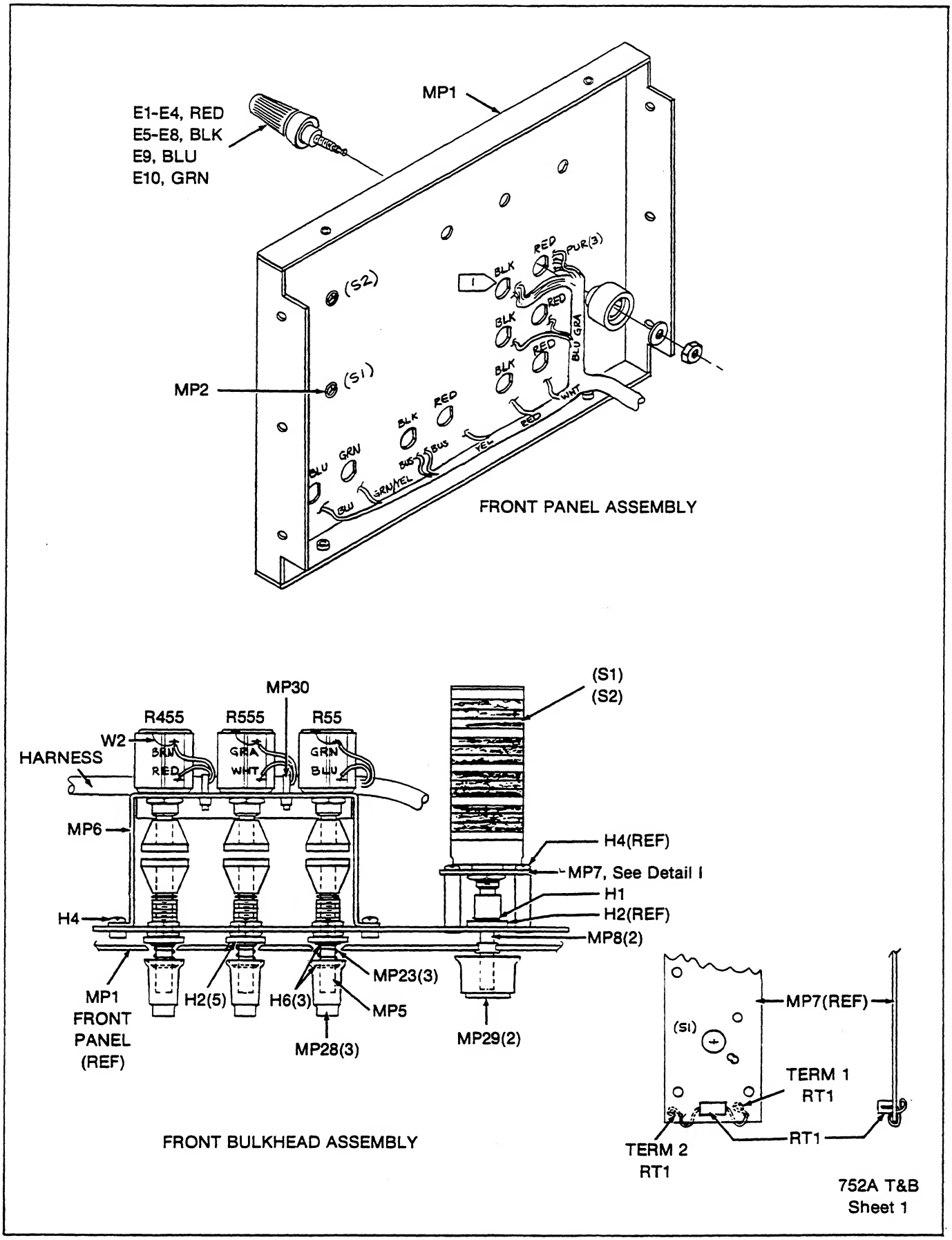


Figure 5-1. 752A Final Assembly

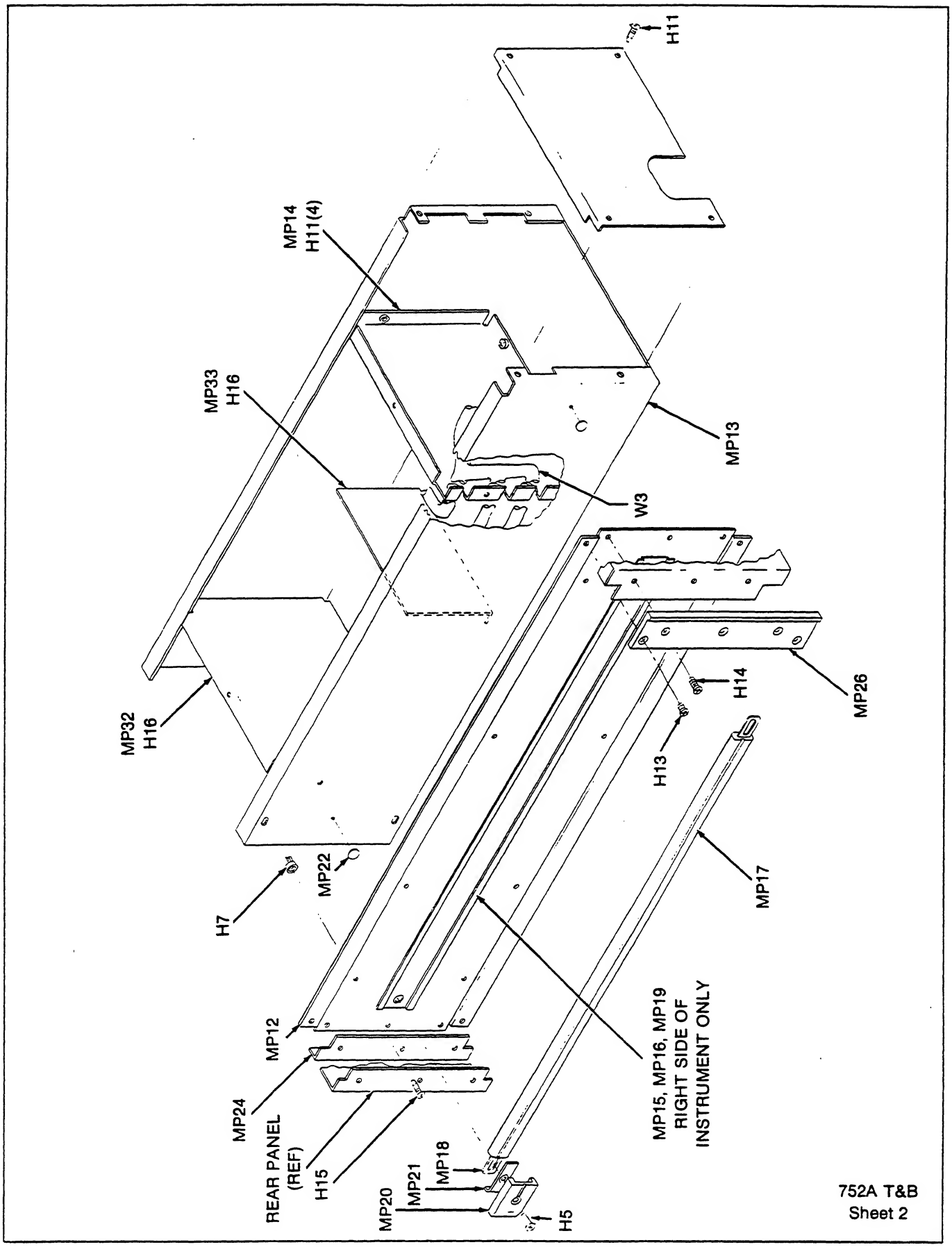


Figure 5-1. 752A Final Assembly (cont)

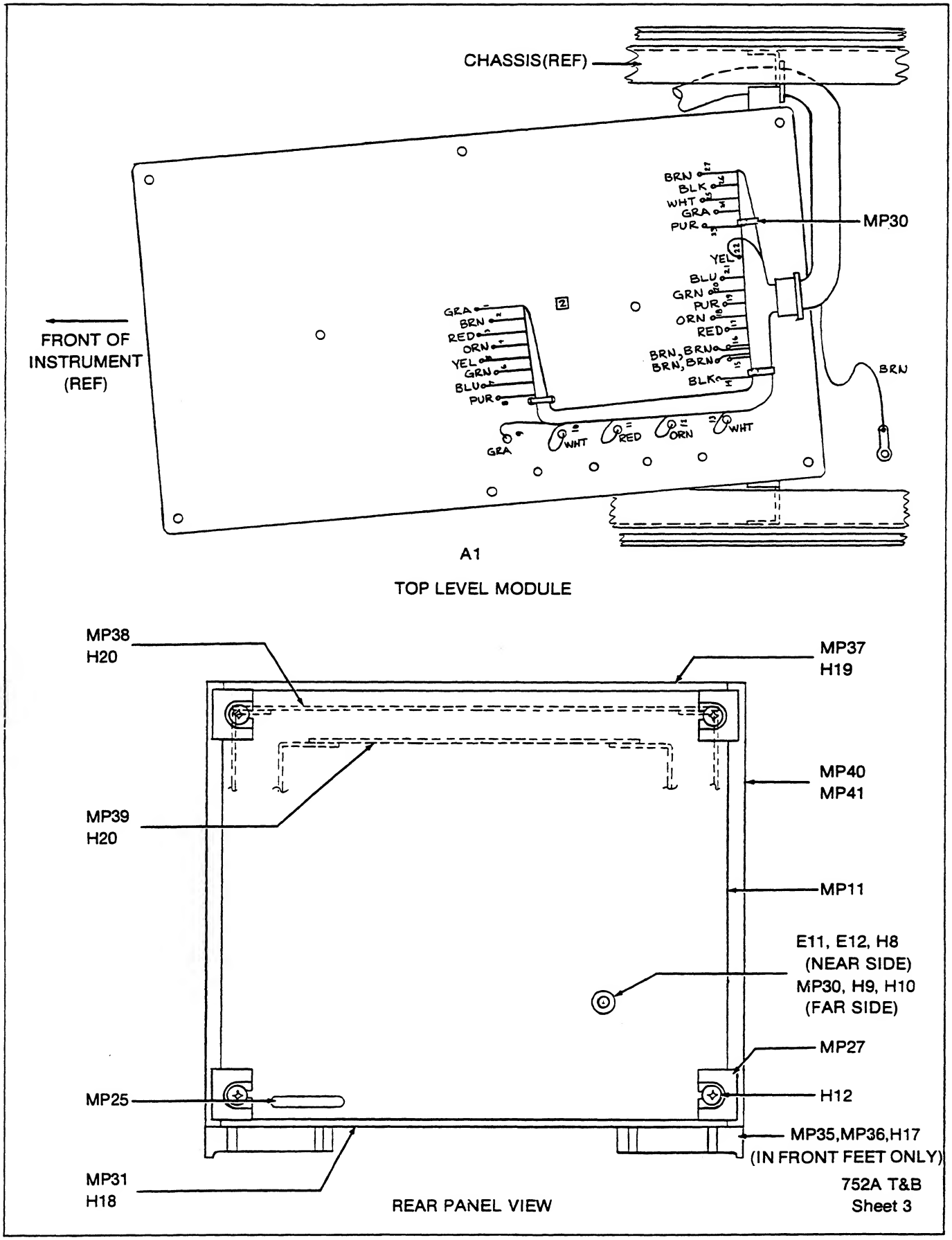


Figure 5-1. 752A Final Assembly (cont)

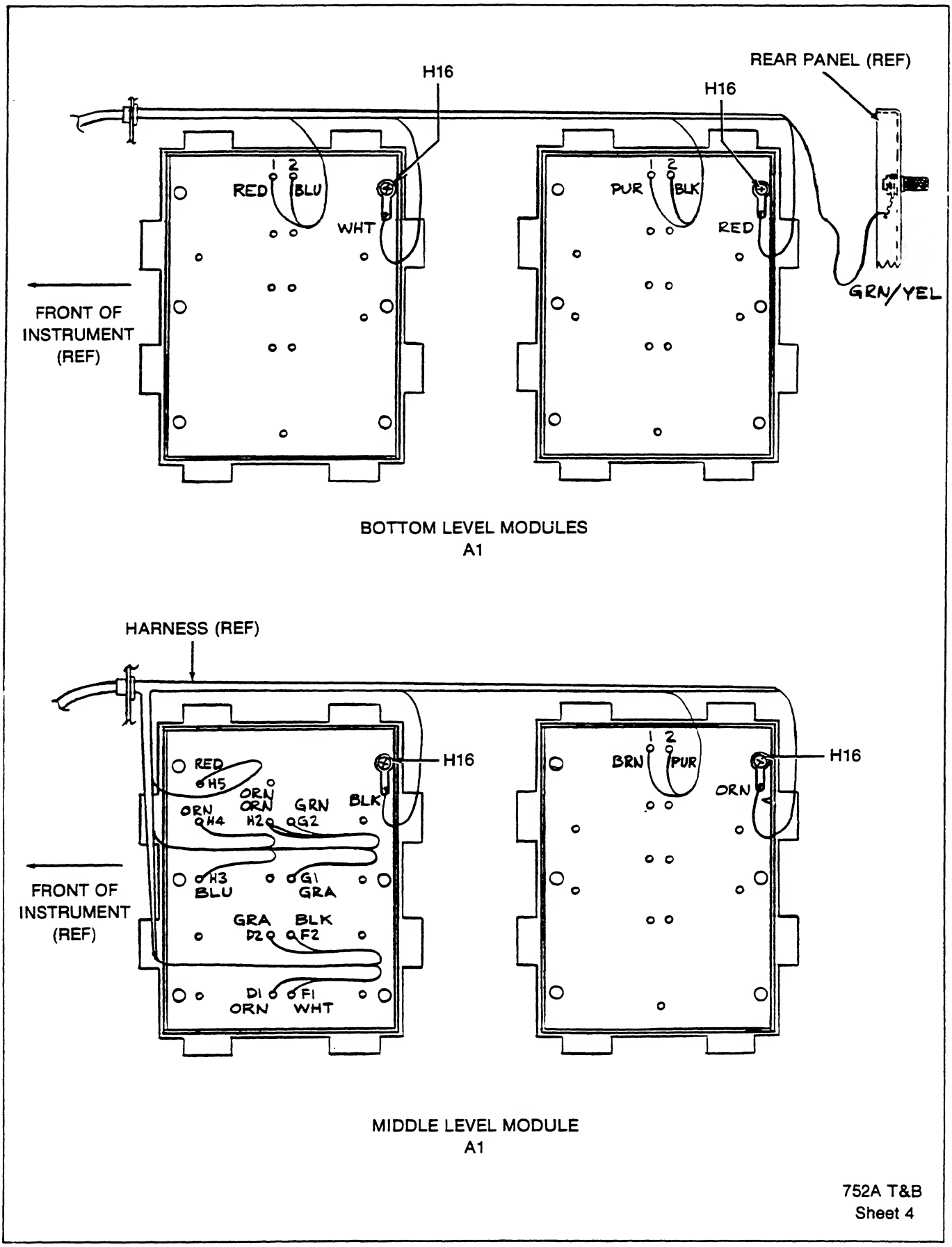


Figure 5-1. 752A Final Assembly (cont)

Section 6
Accessories

6-1. INTRODUCTION

6-2. This section of the manual describes the accessories available for use with the model 752A.

6-3. DUAL MOUNTING FASTENER (M00-800-523)

6-4. The Dual Mounting Fastener is a 8-32 threaded fastener designed for bolting two half-rack width instuments together. The Dual Mounting Fasteners may be used for either dual rack mounting applications (as used in the M07-200-603 Full-Width Rack Mount Kit) or dual table top applications. Four M00-800-523 fasteners are required for each pair of half-rack width instruments.

6-5. HALF-WIDTH RACK MOUNT KIT (M07-203-601)

6-6. The Half-Width Rack Mounting kit permits the 752A to be rack mounted. A blank filler panel is supplied, allowing left or right hand offset mounting. Assembly instructions are supplied with the kit.

6-7. FULL- WIDTH RACK MOUNT KIT (M07-200-603)

6-8. The Full Width Rack Mounting kit permits the 752A to be rack mounted side-by-side with another half rack width instrument. This rack mounting method requires the 752A to be bolted to the adjacent instument. To facilitate bolting the instruments together, four M00-800-523, Dual Mounting Fasteners are included with the kit. Assembly instructions are supplied with the kit.

6-9. LOW THERMAL EMF CABLE ASSEMBLY (5440A-7002)

6-10. The Low Thermal EMF Cable Assembly minimizes the effects of thermal emf errors in test and calibration setups. The plugs used are made of the same material as the jacks used in the instument. Connections between the cables and plugs are carefully made to minimize generation of thermal errors.

Section 7

General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable Parts contained in Section 5.

D9816
Westermann Wilhelm Augusta-Anlage
Mannheim-Nackarau Germany

S0482
Sony Corp.
Tokyo, Japan

S3774
Oshino Electric Lamp Works
Tokoyo, Japan

0AD86
IN General
El Paso, TX

0AE89
Autosplice Inc.
Woodside, NY

0BW21
Noritake Co. Inc.
Burlington, MA

0ANF0
Topaz Semiconductor Inc
San Jose, CA

0DSM7
Conductive (Pkg) Containers Inc.
Brookfield, WI

0CLN7
Emhart Fastening Group
Shelton, CT

0FB81
S-Mos Systems Inc.
San Jose, CA

0FFP1
Eveready LTD
Ever Ready Special Battery Div.
Dawley Telford Salop UK

00199
Marcon Electronics Corp
Kearny, NJ

00213
Nytronics Comp. Group Inc.
Darrlington, NC

00327
Welwyn International Inc.
Westlake, OH

00656
Aerovox Corp.
New Bedford, MA

00686
Film Capacitors Inc.
Passaic, NJ

00779
AMP, Inc.
Harrisburg, Pennsylvania

00853
Sangamo Weston Inc
Components Div
Pickens, NC

01091
Allied Plastics Co.
Los Angeles, CA

01101
Wabash Inc
(Formerly Wabash Magnetics)
Wabash, IN

01121
Allen Bradley Co.
Milwaukee, WI

01281
TRW Electronics & Defense Sector
R F Devices
Lawndale, CA

01295
TX Instruments Inc.
Semiconductor Group
Dallas, TX

01526
Genicom
Waynesboro, VA

01537
Motorola Communications &
Electronics Inc.
Franklin Park, IL

01686
RCL Electronics/Shallcross Inc.
Electro Components Div.
Manchester, NH

01884
Sprague Electric Co.
(Now 56289)

01961
Varian Associates Inc.
Pulse Engineering Div.
Convoy, CT

01963
Cherry Electrical Products Corp
Waukegan, IL

02111
Spectrol Electronics Corp.
City of Industry, CA

02114
Amperex Electronic Corp.
Ferrox Cube Div.
Saugerties, NY

02131
General Instrument Corp.
Government Systems Div.
Westwood, MA

02395
Sonar Radio Corp.
Hollywood, FL

02533
Leigh Instruments Ltd.
Frequency Control Div.
Don Mills, Ontario, Canada

02606
Fenwal Labs
Division of Travenal Labs
Morton Grove, IL

02660
Bunker Ramo-Eltra Corp.
Amphenol NA Div.
Broadview, IL

02697
Parker-Hannifin Corp.
O-Ring Div
Lexington, KY

02735
RCA-Solid State Div.
Somerville, NJ

02768
ITW (IL Tool Works)
Fastex Division
Des Plaines, IL

02799
Arco Electronics Inc.
Chatsworth, CA

03296
Nylon Molding Corp.
Monrovia, CA

03445
Lercon Electronics Inc
Burbank, CA

03508
General Electric Co.
Semiconductor Products
& Batteries
Auburn, NY

03797
Genisco Technology Corp.
Eltronics Div.
Rancho Dominquez, CA

03877
Gilbert Engineering Co.Inc
Incon Sub of Transitron
Electronic Corp.
Glendale, AZ

03888
KDI Electronics Inc.
Pyrofilm Div.
Whippany, NJ

03911
Clairex Corp.
Clairex Electronics Div.
Mount Vernon, NY

03980
Muirhead Inc.
Mountainside, NJ

04009
Cooper Industries, Inc.
Arrow Hart Div.
Hartford, CT

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, CA

04221
Midland-Ross Corp.
Midtex Div.
N. Mankato, MN

04222
AVX Corp.
AVX Ceramics Div.
Myrtle Beach, SC

04423
Telonic Berkley Inc.
Laguna Beach, CA

04713
Motorola Inc.
Semiconductor Group
Phoenix, AZ

04946
Standard Wire and Cable
Rancho Dominquez, CA

05173
General Radio
NY,NY.
Replaced by:

24655
Genrad,INC.
Concord, MA

05236
Jonathan Mfg. Co.
Fullerton, CA

05245
Corcom Inc.
Libertyville, IL

05276
ITT Pomona
Electronics Div.
Pomona, CA

05277
Westinghouse Elec. Corp.
Semiconductor Div.
Youngwood, PA

05347
Ultronix Inc
Grand Junction, CO

05397
Union Carbide Corp.
Materials Systems Div.
Cleveland. OH

05571
Sprague Electric Co.
(Now 56289)

05574
Viking Connectors Inc
Sub of Criton Corp.
Chatsworth, CA

05791
LYN-TRON
Burbank, CA

05820
EG & G Wakefield Engineering
Wakefield, MA

05839
Advance Electrical
Chicago, IL

05972
Loctite Corp.
Newington, CT

Federal Supply Codes for Manufacturers (cont)

06001
General Electric Co.
Electric Capacitor Product Section
Columbia, SC

06141
Fairchild Weston Systems Inc.
Data Systems Div.
Sarasota, FL

06192
La Deau Mfg. Co.
Glendale, CA

06229
Electrovert Inc.
Elmsford, NY

06383
Panduit Corp.
Tinley Park, IL

06473
Bunker Ramo Corp.
Amphenol NA Div.
SAMS Operation
Chatsworth, CA

06540
Mite Corp
Amatom-Electrical Div

06555
Beede Electrical Instrument
Penacook, NH

06665
Precision Monolithics
Sub of Bourns Inc.
Santa Clara, CA

06666
General Devices Co. Inc.
INpolis, IN

06739
Electron Corp.
Littleton, CO

06743
Gould Inc.
Foil Div.
Eastlake, OH

06751
Components Inc.
Semcor Div.
Phoenix, AZ

06776
Robinson Nugent Inc.
New Albany, IN

06915
Richco Plastic Co.
Chicago, IL

06961
Vernitron Corp.
Piezo Electric Div.
Bedford, OH

06980
EIMAC
(See Varian)
San Carlos, CA

07047
Ross Milton Co., The
Southampton, PA

07138
Westinghouse Electric Corp.
Industrial & Government
Tube Div.
Horseheads, NY

07233
Benchmark Technology Inc.
City of Industry, CA

07239
Biddle Instruments
Blue Bell, PA

07256
Silicon Transistor Corp.
Sub of BBF Inc.
Chelmsford, MA

07261
Avnet Corp.
Culver City, CA

07263
Fairchild Semiconductor
North American Sales
Ridgeview, CT

07344
Bircher Co. Inc., The
Rochester, NY

07374
Optron Corp
Woodbridge, CT

07557
Campion Co. Inc.
Philadelphia, PA

07597
Bumdy Corp.
Tape/Cable Div.
Rochester, NY

07716
TRW Inc. (Can use 11502)
IRC Fixed Resistors/
Burlington
Burlington, VT

07792
Lerma Engineering Corp.
Northampton, MA

07810
Bock Corp.
Madison, WI

07910
Teledyne Semiconductor
Mtn. View, CA

07933
Raytheon Co.
Semiconductor Div.
Mountain View, CA

08FG6
Calmos Systems Inc.
Kanata, Ont. Canada

080A9
Dallas Semiconductor
Dallas, TX

08111
MF Electronics
New Rochelle, NY

08235
Industro Transistor Corp.
Long Island City, NY

08261
Spectra-Strip
An Eltra Co.
Garden Grove, CA

08445
Electri-Cord Mfg., Inc
Westfield, PA

08530
Reliance Mica Corp.
Brooklyn, NY

08718
ITT Cannon Electric
Phoenix Div.
Phoenix, AZ

08806
General Electric Co.
Minature Lamp Products
Cleveland, OH

08863
Nylomatic
Fallsington, PA

08988
Skotie Electronics Inc.
Archbald, PA

09021
Airco Inc.
Airco Electronics
Bradford, PA

09023
Cornell-Dublier Electronics
Fuquay-Varina, NC

09214
General Electric Co.
Semiconductor Products Dept.
Auburn, NY

09353
C and K Components Inc.
Newton, MA

09423
Scientific Components Inc.
Santa Barbara, CA

09922
Bumdy Corp.
Norwalk, CT

09969
Dale Electronics Inc.
Yankton, SD

09975
Burroughs Corp.
Electronics Components
Detroit, MI

1A791
LFE Electronics
Danvers, MA

1B715
(United Shoe & Nylock Corp)
-Nylock Fastener Corp.-
Paramus, NJ

10059
Barker Engineering Corp.
Kenilworth, NJ

10389
IL Tool Works Inc.
Licon Div.
Chicago, IL

11236
CTS Corp.
Resistor Products Div.
Berne, IN

11237
CTS Corp of CA
Electro Mechanical Div.
Paso Robles, CA

11295
ECM Motor Co.
Schaumburg, IL

11358
Columbia Broadcasting System
CBS Electronic Div.
Newburyport, MA

11403
Vacuum Can Co.
Best Coffee Maker Div.
Chicago, IL

11502 (can also use 35009)
TRW Inc.
TRW Resistive Products Div.
Boone, NC

11503
Keystone Columbia Inc.
Freemont, IN

11532
Teledyne Relays Teledyne
Industries Inc.
Hawthorne, CA

11711
General Instrument Corp.
Rectifier Div.
Hicksville, NY

11726
Qualidyne Corp.
Santa Clara, CA

12014
Chicago Rivet & Machine Co.
Naperville, IL

12020
Ovenaire
Div. of Electronic Technologies
Charlottesville, VA

12038
Simco
(Div of Ransburg Corp)
Hatfield, PA

12040
National Semiconductor Corp.
Danbury, CT

12060
Diodes Inc.
Northridge, CA

12136
PHC Industries Inc.
Formerly Philadelphia Handle Co.
Camden, NJ

12300
AMF Canada Ltd.
Potter-Brumfield
Guelph, Ontario, Canada

12323
Practical Automation Inc.
Shelton, CT

12327
Freeway Corp.
Cleveland, OH

12406
Elpac Electronics Inc.
Santa Ana, CA

12443
Budd Co.,The
Plastics Products Div.
Phoenixville, PA

12581
Hitachi Metals International Ltd.
Hitachi Magna-Lock Div.
Big Rapids, MO

12615
US Terminals Inc.
Cincinnati, OH

12617
Hamlin Inc.
LaKe Mills, WI

12673
Wesco Electrical
Greenfield, MA

12697
Clarostat Mfg. Co. Inc.
Dover, NH

12749
James Electronic Inc.
Chicago, IL

12856
MicroMetals Inc.
Anaheim, CA

12881
Metex Corp.
Edison, NJ

12895
Cleveland Electric Motor Co.
Cleveland, OH

12954
Microsemi Corp.
Components Group
Scotsdale, AZ

12969
Unitrode Corp.
Lexington, MA

13050
Potter Co.
Wesson, MS

13103
Thermalloy Co., Inc.
Dallas, TX

13327
Solitron Devices Inc.
Tappan, NY

13511
Bunker-Ramo Corp.
Amphenol Cadre Div.
Los Gatos, CA

13606
Sprague Electric Co.
(Use 56289)

13689
SPS Technologies Inc.
Hatfield, NJ

13764
Micro Plastics
Flippin, AZ

13919
Burr-Brown Research Corp.
Tucson, AZ

14099
Semtech Corp.
Newbury Park, CA

14140
McGray-Edison Co.
Commercial Development Div.
Manchester, NH

14189
Ortronics, Inc.
Orlando, FL

14193
Cal-R-Inc.
Santa Monica, CA

14301
Anderson Electronics
Hollidaysburg, PA

14329
Wells Electronics Inc.
South Bend, IN

14482
Watkins-Johnson Co.
Palo Alto, CA

14552
Microsemi Corp.
(Formerly Micro-Semiconductor)
Santa Ana, CA

14604
Elmwood Sensors, Inc
Pawtucket, RI

14655
Cornell-Dublier Electronics
Div. of Federal Pacific
Electric Co. Govt Cont Dept.
Newark, NJ

14704
Crydom Controls
(Division of Int Rectifier)
El Segundo, CA

14752
Electro Cube Inc.
San Gabriel, CA

14936
General Instrument Corp.
Discrete Semi Conductor Div.
Hicksville, NY

14949
Trompeter Electronics
Chatsworth, CA

15412
Amtron
Midlothian, IL

15542
Scientific Components Corp.
Mini-Circuits Laboratory Div.
Brooklyn, NY

15636
Elec-Trol Inc.
Saugus, CA

15782
Bausch & Lomb Inc.
Graphics & Control Div.
Austin, TX

15801
Fenwal Eletronics Inc.
Div. of Kidde Inc.
Framingham, MA

15818
Teledyne Inc. Co.
Teledyne Semiconductor Div.
Mountain View, CA

15849
Useco Inc.
(Now 88245)

15898
International Business
Machines Corp.
Essex Junction, VT

16068
International Diode Div.
Harrison, NJ

16162
MMI
Southfield, MI

16245
Conap Inc.
Olean, NY

16258
Space-Lok Inc.
Burbank, CA

16352
Codi Corp.
Linden, NJ

16469
MCL Inc.
LaGrange, IL

16473
Cambridge Scientific Industries
Div. of Chemed Corp.
Cambridge, MD

16733
Cablewave Systems Inc.
North Haven, CT

16742
Paramount Plastics
Fabricators Inc.
Downey, CA

16758
General Motors Corp.
Delco Electronics Div.
Kokomo, IN

17069
Circuit Structures Lab
Burbank, CA

17117
Electronic Molding Corp.
Woonsocket, RI

17338
High Pressure Eng. Co. Inc.
OK City, OK

17504
Aluminum Filter Co.
Carpinteria, CA

17545
Atlantic Semiconductors Inc.
Asbury Park, NJ

17745
Angstrohm Precision, Inc.
Hagerstown, MD

17856
Siliconix Inc.
Santa Clara, CA

18178
E G & Gvactee Inc.
St. Louis, MO

18235
KRL/Bantry Components Inc.
Manchester, NH

18310
Concord Electronics
New York, NY

18324
Signetics Corp.
Sacramento, CA

18377
Parlex Corp.
Methuen, MA

18520
Sharp Electronics Corp.
Paramus, NJ

18542
Wabash Inc.
Wabash Relay & Electronics Div.
Wabash, IN

18565
Chomerics Inc.
Woburn, MA

18612
Vishay Intertechnology Inc.
Vishay Resistor Products Group
Malvern, PA

18632
Norton-Chemplast
Santa Monica, CA

18677
Scanbe Mfg. Co.
Div. of Zero Corp.
El Monte, CA

18736
Voltronics Corp.
East Hanover, NJ

18786
Micro-Power
Long Island City, NY

18927
GTE Products Corp.
Precision Material Products
Business Parts Div.
Titusville,PA

19080
Robinson Electronics Inc.
San Luis Obispo, CA

19112
Garry Corp.
Langhorne, PA

19315
Bendix Corp., The
Navigation & Control Group
Terboro, NJ

19451
Perine Machine Tool Corp.
Kent, WA

19482
Delta Electronics
Alexandria, VA

19613
MN Mining & Mfg. Co.
Textool Products Dept.
Electronic Product Div.
Irving, TX

19647
Caddock Electronics Inc.
Riverside, CA

19701
Mepco/Centralab Inc.
A N. American Philips Co.
Mineral Wells, TX

2B178
Wire Products
Cleveland, OH

2K262
Boyd Corporation
Portland, OR

2Y384
North American Philips Lighting Corp.
Van Wert, OH

20584
Enochs Mfg. Inc.
INpolis, IN

20891
Cosar Corp.
Dallas, TX

21317
Electronics Applications Co.
El Monte, CA

21604
Buckeye Stamping Co.
Columbus, OH

21845
Solitron Devices Inc.
Semiconductor Group
Rivera Beach, FL

21847
Aertech
Now TRW Microwave Inc.
Sunnyvale, CA

21962
Vectron Corp.
Replaced by: S.W. Electronics

22526
DuPont, El DeNemours & Co. Inc.
DuPont Connector Systems
Advanced Products Div.
New Cumberland, PA

22626
Micro Semiconductor
(Now 14552)

22670
GM Nameplate
Seattle, WA

22767
ITT Semiconductors
Palo Alto, CA

22784
Palmer Inc.
Cleveland, OH

23050
Product Comp. Corp.
Mount Vernon, NY

23223
CTS Microelectronics
Lafayette, NY

23237
I.R.C., Inc.
Microcircuits Divison
Philadelphia, PA

23302
S.W. Electronics & Mfg. Corp.
Cherry Hill, NJ

23730
Mark Eyelet and Stamping Inc.
Wolcott, CT

23732
Tracor Applied Sciences Inc.
Rockville, MD

23880
Stanford Applied Engineering
Santa Clara, CA

23936
William J. Purdy Co.
Pamotor Div.
Burlingame, CA

24347
Penn Engineering Co.
S. El Monte, CA

24355
Analog Devices Inc.
Norwood, MA

24444
General Semiconductor
Industries, Inc.
Tempe, AZ

24546
Bradford Electronics
Bradford, PA

24618
Transcon Mfg.
Now: D.J. Associates Inc.

24655
Genrad Inc.
(Replaced General Radio 05173)
Concord, MA

24759
Lenox-Fugle Electronics Inc.
South Plainfield, NJ

24796
AMF Inc.
Potter & Brumfield Div.
San Juan Capistrano, CA

24931
Specialty Connector Co.
Greenwood, IN

24995
ECS
Grants Pass, OR

25088
Siemen Corp.
Isilen, NJ

25099
Cascade Gasket
Kent, WA

25403
Amperex Electronic Corp.
Semiconductor & Micro-Circuit Div.
Slatersville, RI

25435
Moldtronics, Inc
Downers Grove, IL

25706
Daburn Electronic & Cable Corp.
Norwood, NJ

26402
Lumex,Inc.
Bayshore, NY

26629
Frequency Sources Inc.
Sources Div.
Chelmsford, MA

26806
American Zettler Inc.
Irvine, CA

27014
National Semiconductor Corp.
Santa Clara, CA

27167
Corning Glass Works Corning
Electronics
Wilmington, NC

27264
Molex Inc.
Lisle, IL

27440
Industrial Screw Products
Los Angeles, CA

27494
Staffall, Inc.
Providence, RI

27745
Associated Spring Barnes Group Inc.
Syracuse, NY

27918
Component Parts Corp.
Bellmore, NY

27956
Relcom (Now 14482)

28175
Alpha Metals
Chicago, IL

28198
Positronic Industries
Springfield, MO

28213
MN Mining & Mfg. Co.
Consumer Products Div.
3M Center
Saint Paul, MN

28309
Kaiser
Minette,AL

28425
Serv-O-Link
Euless, TX

28478
Deltrol Corporation
Deltrol Controls Div.
Milwaukee, WI

28480
Hewlett Packard Co.
Corporate HQ
Palo Alto, CA

28484
Emerson Electric Co.
Gearmaster Div.
McHenry, IL

28520
Heyco Molded Products
Kenilworth, NJ

28932
Lumax Industrials, Inc
Altoona, PA

29083
Monsanto Co.
Santa Clara, CA

29604
Stackpole Components Co.
Raleith, NC

29907
Omega Engineering Inc.
Stamford, CT

3D536
Aimsco Inc.
Seattle, WA

30035
Jolo Industries Inc.
Garden Grove, CA

30045
Solid Power Corp.
Farmingdale, NY

30146
Symbex Corp.
Painesville, OH

30148
AB Enterprise Inc.
Ahoskie, NC

30161
Aavid Engineering Inc.
Laconia, NH

30315
Itron Corp.
San Diego, CA

30323
IL Tool Works Inc.
Chicago, IL

30800
General Instrument Corp.
Capacitor Div.
Hicksville, NY

30838
Fastec
Chicago,ILL

31019
Solid State Scientific Inc.
Willow Grove, PA

31091
Alpha Industries Inc.
Microelectronics Div.
Hatfield, PA

31323
Metro Supply Company
Sacramento, CA

31433
Kemet Electonics Corp.
Simpsonville, NC

31448
Army Safeguard Logistics Command
Huntsville, AL

31471
Gould Inc
Semiconductor Div
Santa Clara, CA

31522
Metal Masters Inc.
Baldwin, MS

31746
Cannon Electric
Woodbury, TN

31827
Budwig
Ramona, CA

31918
ITT-Schadow
Eden Prairie, MN

32293
Intersil
Cupertino, CA

32539
Mura Corp.
Westbury, Long Island, N.Y.

32559
Bivar
Santa Ana, CA

32719
Siltronics
Santa Ana, CA

32767
Griffith Plastics Corp.
Burlingame, CA

32879
Advanced Mechanical Components
Northridge, CA

32897
Murata Erie North America Inc.
Carlisle Operations
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Div.
Riverside, CA

33025
M/A ComOmni Spectra, Inc. (Replacing Omni Spectra)
Microwave Subsystems Div.
Tempe, AZ

33096
CO Crystal Corp.
Loveland, CO

33173
General Electric Co.
Owensboro, KY

33246
Epoxy Technology Inc.
Billerica, MA

33292
Pioneer Sterilized Wiping Cloth Co.
Portland, OR

33297
NEC Electronics USA Inc.
Electronic Arrays Inc. Div.
Mountain View, CA

33919
Nortek Inc.
Cranston, RI

34114
Oak Industries
Rancho Bernardo, CA

34263
CTS Electronics Corp.
Brownsville,TX

34333
Silicon General Inc.
Garden Grove, CA

34335
Advanced Micro Devices (AMD)
Sunnyvale, CA

34359
MN Mining & Mfg. Co.
Commercial Office Supply Div.
Saint Paul, MN

34371
Harris Corp.
Harris Semiconductor
Products Group
Melbourne, FL

34576
Rockwell International Corp.
Newport Beach, CA

34641
Instrument Specialties
Euless, TX

34649
Intel Corp.
Santa Clara, CA

34802
Electromotive Inc.
Kenilworth, NJ

34848
Hartwell Special Products
Placentia, CA

35009
Renfrew Electric Co. Ltd.
IRC Div.
Toronto, Ontario, Canada

35986
Amrad
Melrose Park, IL

36665
Mitel Corp.
Kanata, Ontario, Canada

36701
Van Waters & Rogers
Valley Field, Quebec, Canada

37942
Mallory Capacitor Corp.
Sub of Emhart Industries
INpolis, IN

39003
Maxim Industries
Middleboro, MA

4F434
Plastic Sales
Los Angeles, CA

40402
Roderstein Electronics Inc.
Statesville, NC

42498
National Radio
Melrose, MA

43543
Nytronics Inc.(Now 53342)

43744
Panasonic Industrial Co.
San Antonio, TX

43791
Datron Systems
Wilkes Barre, PA

44655
Ohmite Mfg. Co.
Skokie, IL

47001
Lumberg Inc.
Richmond, VA

47379
ISOCOM
Campbell, CA

49569
IDT (International Development & Trade)
Dallas, TX

49671
RCA Corp.
New York, NY

49956
Raytheon Company
Executive Offices
Lexington, MA

5D590
Mostek Corp.
Replaced by: SGS Thompson Microelectronics

5F520
Panel Components Corp.
Santa Rosa, CA

5P575
Nobel Electronics
Suffern, NY

5W664
NDK
Div. of Nihon Dempa Kogyo LTD
Lynchburg, VA

5U802
Dennison Mfg. Co.
Framingham, MA

50088
SGS - Thomson Microelectronics Inc.
Carrollton, TX

50120
Eagle-Picher Industries Inc.
Electronics Div.
CO Springs, CO

50157
Midwest Components Inc.
Muskegon, MS

50356
Teac Corp. of America
Industrial Products Div
Montebello, CA

50364
MMI, Inc.(Monolithic Memories Inc)
Military Products Div.
Santa Clara, CA

50472
Metal Masters, Inc.
City of Industry, CA

50541
Hypertronics Corp.
Hudson, MA

50558
Electronic Concepts, Inc.
Eatontown, NJ

50579
Litronix Inc.
Cupertino, CA

50891
Semiconductor Technology
Stuart, FL

50934
Tran-Tec Corp
Columbus, NE

51167
Aries Electronics Inc.
Frenchtown, NJ

51284
Mos Technology
Norristown, PA

51249
Heyman Mfg. Co.
Cleveland, OH

51372
Verbatim Corp.
Sunnyvale, CA

51398
MUPAC Corp.
Brockton, MA

51406
Murata Erie, No. America Inc.
(Also see 72982)
Marietta, GA

51499
Amtron Corp.
Boston, MA

51506
Accurate Screw Machine Co.
(ASMCO) Nutley, NJ

51605
CODI Semiconductor Inc.
Kenilworth, NJ

51642
Centre Engineering Inc.
State College, PA

51705
ICO/Rally
Palo alto, CA

51791
Statek Corp.
Orange, CA

51984
NEC America Inc.
Falls Church, VA

52063
Exar Integrated Systems
Sunnyvale, CA

52072
Circuit Assembly Corp.
Irvine, CA

52152
MN Mining & Mfg.
Saint Paul, MN

52333
API Electronics
Haugpauge,Long Island,NY

52361
Communication Systems
Piscataway, NJ

52500
Amphenol, RF Operations
Burlington, MA

52525
Space-Lok Inc.
Lerco Div.
Burbank, CA

52531
Hitachi Magnetics
Edmore, MO

52745
Timco
Los Angeles, CA

52763
Stettner-Electronics Inc.
Chattanooga, TN

52769
Sprague-Goodman Electronics Inc.
Garden City Park, NY

52771
Monitern Corp.
Amatrom Div.
Santa Clara, CA

52840
Western Digital Corp.
Costa Mesa, CA

53021
Sangamo Weston Inc.
(See 06141)

53036
Textool Co.
Houston, TX

53184
Xciton Corp.
Lathan, NY

53217
Technical Wire Products Inc.
Santa Barbara, CA

53342
Opt Industries Inc.
Phillipsburg, NJ

53673
Thompson CSF Components Corp.
(Semiconductor Div)
Conaga Park, CA

53718
Airmold/W. R. Grese & Co.
Roanoke Rapids, NC

53848
Standard Microsystems
Hauppauge, NY

53894
AHAM Inc.
RanchoCA, CA

53944
Glow-Lite
Pauls Valley, OK

54178
Plasmetex Industries Inc.
San Marcos, CA

54294
Shallcross Inc.
Smithfield, NC

54453
Sullins Electronic Corp.
San Marcos, CA

54473
Matsushita Electric Corp.
(Panasonic)
Secaucus, NJ

54492
Cinch Clamp Co., Inc.
Santa Rosa, CA

54583
TDK
Garden City, NY

54590
RCA Corp
Distribution & Special Products
Cherry Hill, NY

54869
Piher International Corp.
Arlington Heights, IL

54937
DeYoung Mfg.
Bellevue, WA

54590
RCA Corp.
Electronic Components Div.
Cherry Hill, NJ

55026
American Gage & Machine Co.
Simpson Electric Co. Div.
Elgin, IL

55112
Plessey Capacitors Inc.
(Now 60935)

55261
LSI Computer Systems Inc.
Melville, NY

55285
Beroquist Co.
Minneapolis, MN

55322
Samtech Inc.
New Albany, IN

55408
STI-CO Industries Co
Buffalo, NY

55464
Central Semiconductor Corp.
Hauppauge, NY

55557
Microwave Diode Corp.
W.Stewarstown, NH

55566
R A F Electronic Hardware Inc.
Seymour, CT

55576
Synertek
Santa Clara, CA

55680
Nichicon/America/Corp.
Schaumburg, IL

55943
D J Associates, Inc
(Replaced Transcon Mfg.-24618)
Fort Smith, AZ

56282
Utek Systems Inc.
Olathe, KS

56289
Sprague Electric Co.
North Adams, MA

56365
Square D Co.
Corporate Offices
Palatine, IL

56375
WESCORP
Div. Dal Industries Inc
Mountain View, CA

56481
Shugart Associates
Sub of Xerox Corp.
Sunnyvale, CA

56637
RCD Components Inc.
Manchester, NH

56708
Zilog Inc.
Campbell, CA

56856
Varistor Corp. of TN
Sevierville, TN

56880
Magnetics Inc.
Baltimore, MD

57026
Endicott Coil Co. Inc.
Binghamton, NY

57053
Gates Energy Products
Denver, CO

57170
Cambridge Thermionic
Cambridge, MA
Replaced by:
71279
Interconnection Products Inc.

57668
R-ohm Corp
Irvine, CA

57962
SGS - Thomson Microelectronics Inc
Montgomeryville, PA

58014
Hitachi Magnalock Corp.
(Now 12581)

58104
Simco
Atlanta, GA

58364
BYCAP Inc.
Chicago, IL

58451
Precision Lamp
Cotat, CA

58474
Superior Electric Co.
Bristol, CT

58614
Communications Instruments Inc.
Fairview, NC

59124
KOA-Speer Electronics Inc.
Bradford, PA

59422
Holmberg Electronics
Irvine, CA

59610
Souriau Inc
Valencia, CA

59635
HV Component Associates
Howell, NJ

59640
Supertex Inc.
Sunnyvale, CA

59660
Tusonix Inc.
Tucson, AZ

59730
Thomas and Betts Corp.
IA City, IA

59831
Semtronics Corp.
Watchung, NJ

6H053:
American Components Inc.
an Insilco Co. RPC Div.
Hayesville, NC

6L611
Allen, Robert G. Inc.
Van Nuys, CA

6U850
Burgess Switch Co., Inc
Northbrook, IL

6U095
AMD Enterprises, Inc.
Roswell, GA

6X403
SGS/ATES Semiconductor Corp.
INpolis, IN

6Y440
Micron Technology Inc.
Boise, ID

60046
Power Dynamics Inc
West Orange, NJ

60197
Precicontact Inc.
Langhorne, PA

60386
Squires Electronics Inc
Cornelius, OR

60395
Xicor Inc.
Milpitas, CA

60399
Torin Engineered Blowers
Div. of Clevepak Corp.
Torrington, CT

60496
Micrel Inc.
Sunnyvale, CA

60705
Cera-Mite Corp.
(formerly Sprague)
Grafton, WI

60911
Inmos Corp.
CO Springs, CO

60935
Westlake Capacitor Inc.
Tantalum Div.
Greencastle, IN

60958
ACIC
Intercomp Wire & Cable Div.
Hayesville, NC

61271
Fujitsu Microelectronics Inc
San Jose, CA

61394
SEEQ Technology Inc.
San Jose, CA

61429
Fox Electronics
Cape Coral, FL

61529
Aromat Corp.
New Providence, NJ

61752
IR-ONICS Inc
Warwick, RI

61772
Integrated Device Technology
Santa Clara, CA

61802
Toshiba
Houston, TX

61857
SAN-O Industrial Corp.
Bohemia, Long Island, NY

61935
Schurter Inc.
Petaluma, CA

62351
Apple Rubber
Lancaster, NY

62643
United Chemicon
Rosemont, IL

62712
Seiko Instruments
Torrance, CA

62793
Lear Siegler Inc.
Energy Products Div.
Santa Ana, CA

63743
Ward Leonard Electric Co.Inc.
Mount Vernon, NY

64154
Lamb Industries
Portland, OR

64155
Linear Technology
Milpitas, CA

64537
KDI Electronics
Whippany, NJ

64782
Precision Control Mfg. Inc.
Bellevue, WA

64834
West M G Co.
San Francisco, CA

64961
Electronic Hardware LTD
North Hollywood, CA

65092
Sangamo Weston Inc.
Weston Instruments Div.
Newark, NJ

65786
Cypress Semi
San Jose, CA

65940
Rohm Corp & Whatney
Irvine, CA

65964
Evox Inc.
Bannockburn, IL

66150
Entron Inc.
Winslow Teltronics Div.
Glendale, NY

66302
VLSI Technology Inc.
San Jose, CA

66419
Exel
San Jose, CA

66450
Dyna-Tech Electronics, Inc
Walled Lake, MI

66608
Bering Industries
Freemont, CA

66891
BKC International Electronics
Lawrence, MA

66958
SGS Semiconductor Corp.
Phoenix, AZ

66967
Powerex Inc
Auburn, NY

67183
Altera
Santa Clara, CA

68919
WIMA
% Harry Levinson Co.
Seattle, WA

7F361
Richmond-Division of Dixico
% Zellerbach Paper Co.
Seattle, WA

7F844
Moore Business Forms, Inc
Seattle, WA

7G902
Textron Inc.
Camcar Div.
Rockford, IL

7J395
Universal Plastics
Welshpool, WA

7J696
AMD Plastics
East Lake, OH

7K354
Omni Spectra Inc
Los Altos, CA

7Z884
ALPS
Seattle, WA

7X634
Duracell USA
Div. of Dart & Kraft Inc.
Valdese, NC

70290
Almetal Universal Joint Co.
Cleveland, OH

70485
Atlantic India Rubber Works Inc.
Chicago, IL

70563
Amperite Company
Union City, NJ

70903
Cooper-Belden Corp.
Geneva, IL

71002
Bimbach Co. Inc.
Farmingdale, NY

71034
Bliley Electric Co.
Erie, PA

71183
Westinghouse Electric Corp.
Bryant Div.
Bridgeport, CT

71279
Interconnection Products Inc.
Formerly Midland-Ross Cambion Div.
Santa Ana, CA

71400
Bussman Manufacturing
Div. McGraw-Edison Co.
St. Louis, MO

71450
CTS Corp.
Elkhart, IN

71468
ITT Cannon Div. of ITT
Fountain Valley, CA

71482
General Instrument Corp.
Clare Div.
Chicago, IL

71590
Mepco/Centralab
A North American Philips Co.
Fort Dodge, IA

71707
Coto Corp.
Providence, RI

71744
General Instrument Corp.
Lamp Div/Worldwide
Chicago, IL

71785
TRW Inc.
Cinch Connector Div.
Elk Grove Village, IL

71984
Dow Corning Corp.
Midland, MI

72005
AMAX Specialty Metals Corp.
Newark, NJ

72136
Electro Motive Mfg. Corp.
Florence, NC

72228
AMCA International Corp.
Continental Screw Div.
New Bedford, MA

72259
Nytronics Inc.
New York, NY

72619
Amperex Electronic Corp.
Dialight Div.
Brooklyn, NY

72653
G C Electronics Co.
Div. of Hydrometals Inc.
Rockford, IL

72794
Dzus Fastner Co. Inc.
West Islip, NY

72928
Gulton Industries Inc.
Guderman Div.
Chicago, IL

72962
Elastic Stop Nut
Div. of Harrard Industries
Union, NJ

72982
Erie Specialty Products, Inc
Formerly: Murata Erie
Erie, PA

73138
Beckman Industrial corp.
Helipot Div.
Fullerton, CA

73168
Fenwal Inc.
Ashland, MA

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrance, CA

73445
Amperex Electronic Corp.
Hicksville, NY

73559
Carlingswitch Inc.
Hartford, CT

73586
Circle F Industries
Trenton, NJ

73734
Federal Screw Products Inc.
Chicago, IL

73743
Fischer Special Mfg. Co.
Cold Spring, KY

73893
Microdot
Mt. Clemens, MS

73899
JFD Electronic Components
Div. of Murata Erie
Oceanside, NY

73905
FL Industries Inc.
San Jose, CA

73949
Guardian Electric Mfg. Co.
Chicago, IL

74199
Quam Nichols Co.
Chicago, IL

74217
Radio Switch Co.
Marlboro, NJ

74306
Piezo Crystal Co.
Div. of PPA Industries Inc.
Carlisle, PA

74445
Holo-Krome Co.
Elmwood, CT

74542
Hoyt Elect.Instr. Works Inc.
Penacook, NH

74840
IL Capacitor Inc.
Lincolnwood, IL

74970
Johnson EF Co.
Waseca, MN

75042
TRW Inc.
IRC Fixed Resistors
Philadelphia, PA

75297
Kester Solder Div.
Litton Systems, Inc
Des Plaines, IL

75376
Kurz-Kasch Inc.
Dayton, OH

75378
CTS Knights Inc.
Sandwich, IL

75382
Kulka Electric Corp.
(Now 83330)
Mount Vernon, NY

75569
Performance Semiconductor Corp.
Sunnyvale, CA

75915
Littelfuse Tracor
(Formerly: Tracor-Littelfuse)
Des Plaines, IL

76854
Oak Switch Systems Inc.
Crystal Lake, IL

77122
TRW Assemblies & Fasteners Group
Fastener Div.
Moutainside, NJ

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, IN

77542
Ray-O-Vac Corp
Madison, WI

77638
General Instrument Corp.
Rectifier Div.
Brooklyn, NY

77900
Shakeproof Lock Washer Co.
(Now 78189)

77969
Rubbercraft Corp. of CA Ltd.
Torrance, CA

78189
IL Tool Works Inc.
Shakeproof Div.
Elgin, IL

78277
Sigma Instruments Inc.
South Braintree, MA

78290
Struthers Dunn Inc.
Pitman, NJ

78553
Eaton Corp.
Engineered Fastener Div.
Cleveland, OH

Federal Supply Codes for Manufacturers (cont)

78592
Stoeger Industries
South Hackensack, NJ

79497
Western Rubber Co.
Goshen, IN

79727
C - W Industries
Southampton, PA

79963
Zierick Mfg. Corp.
Mount Kisco, NY

8C798
Ken-Tronics, Inc.
Milan, IL

8D528
Baumgartens
Atlanta, GA

8F330
Eaton Corp.
Cutler Hammer Product Sales Office
Mountain View, CA

8T100
Tellabs Inc.
Naperville, IL

80009
Tektronix
Beaverton, OR

80031
Mepco/Electra Inc.
Morristown, NJ

80032
Ford Aerospace &
Communications Corp.
Western Development
Laboratories Div.
Palo Alto, CA

80145
LFE Corp.
Process Control Div.
Clinton, OH

80183
Sprague Products
(Now 56289)

80294
Bourns Instruments Inc.
Riverside, CA

80583
Hammerlund Mfg. Co. Inc.
Paramus, NJ

80640
Computer Products Inc.
Stevens-Arnold Div.
South Boston, MA

81073
Grayhill Inc.
La Grange, IL

81312
Litton Systems Inc.
Winchester Electronics Div.
Watertown, CT

81439
Therm-O-Disc Inc.
Mansfield, OH

81483
International Rectifier Corp.
Los Angeles, CA

81590
Korry Electronics Inc.
Seattle, WA

81741
Chicago Lock Co.
Chicago, IL

82227
Airpax Corp.
Cheshire Div.
Cheshire, CT

82240
Simmons Fastner Corp.
Albany, NY

82305
Palmer Electronics Corp.
South Gate, CA

82389
Switchcraft Inc.
Sub of Raytheon Co.
Chicago, IL

82415
Airpax Corp
Frederick Div.
Frederick, MD

82872
Roanwell Corp.
New York, NY

82877
Rotron Inc.
Custom Div.
Woodstock, NY

82879
ITT
Royal Electric Div.
Pawtucket, RI

83003
Varo Inc.
Garland, TX

83014
Hartwell Corp.
Placentia, CA

83055
Signalite Fuse Co.
(Now 71744)

83058
TRW Assemblies & Fasteners Group
Fasteners Div.
Cambridge, MA

83259
Parker-Hannifin Corp.
O-Seal Div.
Culver City, CA

83298
Bendix Corp.
Electric & Fluid Power Div.
Eatonville, NJ

83315
Hubbell Corp.
Mundelein, IL

83330
Kulka Smith Inc.
A North American Philips Co.
Manasquan, NJ

83478
Rubbercraft Corp. of America
West Haven, CT

83553
Associated Spring Barnes Group
Gardena, CA

83740
Union Carbide Corp.
Battery Products Div.
Danbury, CT

84171
Arco Electronics
Commack, NY

84411
American Shizuki
TRW Capacitors Div.
Ogallala, NE

84613
FIC Corp.
Rockville, MD

84682
Essex Group Inc.
Peabody, MA

84830
Lee Spring Co. Inc
Brooklyn, NY

85367
Bearing Distributing Co.
San Fransisco, CA

85372
Bearing Sales Co.
Los Angeles, CA

85480
W. H. Brady Co.
Industrial Product
Milwaukee, WI

85840
Brady WH Co
Industrial Products Div
Milwaukee, WI

85932
Electro Film Inc.
Valencia, CA

86577
Precision Metal Products Co.
Peabody, MA

86684
Radio Corp. of America
(Now 54590)

86928
Seastrom Mfg. Co. Inc.
Glendale, CA

87034
Illuminated Products Inc.
(Now 76854)

87516
Standard Crystal
KS City, KS

88044
Aeronautical Standards Group
Dept. of Navy & Air Force

88219
GNB Inc.
Industrial Battery Div.
Langhorne, PA

88245
Winchester Electronics
Litton Systems-Useco Div.
Van Nuys, CA

88486
Triangle PWC Inc.
Jewitt City, CT

88690
Essex Group Inc.
Wire Assembly Div.
Dearborn, MI

88786
Atlantic India Rubber Co.
Goshen, IN

88978
Philips (Now Fluke)
Mahwah, NJ

89020
Amerace Corp.
Buchanan Crimptool Products Div.
Union, NJ

89265
Potter-Brumfield
(See 77342)

89462
Waldes Truarc, Inc.
Long Island, NY

89536
John Fluke Mfg. Co., Inc.
Everett, WA

89597
Fredericks Co.
Huntingdon Valley, PA

89709
Bunker Ramo-Eltra Corp.
Amphenol Div.
Broadview, IL

89730
General Electric
Lamp Div.
Newark, NJ

9R216
Data Composition Svc, Inc
Laurel, MD

9S171
Port Plastics
Tukwila, WA

Federal Supply Codes for Manufacturers (cont)

9W423
Amatom
El Mont, CA

90201
Mallory Capacitor Co.
Sub of Emhart Industries Inc.
Indianapolis, IN

90215
Best Stamp & Mfg. Co.
KS City, MO

90303
Duracell Inc.
Technical Sales & Marketing
Bethel, CT

91094
Essex Group Inc.
Suflex/IWP Div.
Newmarket, NH

91247
IL Transformer Co.
Chicago, IL

91293
Johanson Mfg. Co.
Boonton, NJ

91462
Alpha Industries Inc.
Logansport, IN

91502
Associated Machine
Santa Clara, CA

91506
Augat Alcoswitch
N. Andover, MA

91507
Froeliger Machine Tool Co.
Stockton, CA

91637
Dale Electronics Inc.
Columbus, NE

91662
Elco Corp.
A Gulf Western Mfg. Co.
Connector Div.
Huntingdon, PA

91737
ITT Cannon/Gremar
(Now 08718)

91802
Industrial Devices Inc.
Edgewater, NJ

91833
Keystone Electronics Corp.
NY, NY

91836
King's Electronics Co. Inc.
Tuckahoe, NY

91929
Honeywell Inc.
Micro Switch Div.
Freeport, IL

91934
Miller Electric Co.
Woonsocket, RI

91967
National Tel-Tronics
Div. of electro Audio Dynamics Inc
Meadville, PA

91984
Maida Development Co.
Hampton, VA

91985
Norwalk Valve Co.
S. Norwalk, CT

92218
Wakefield Corp., The
Wakefield, ME

92527
VTC Inc.
Bloomington, MN

92607
Tensolite Co.
Div. of Carlisle Corp.
Buchanan, NY

92914
Alpha Wire Corp.
Elizabeth, NJ

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, MA

94144
Raytheon Co.
Microwave & Power Tube Div.
Quincy, MA

94222
Southco Inc.
Concordville, PA

94988
Wagner Electric Corp.
Sub of Mcgraw-Edison Co.
Whippany, NJ

95146
Alco Electronic Products Inc.
Switch Div.
North Andover, MA

95263
Leecraft Mfg. Co.
Long Island City, NY

95275
Vitramon Inc.
Bridgeport, CT

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, OH

95348
Gordo's Corp.
Bloomfield, NJ

95354
Methode Mfg. Corp.
Rolling Meadows, IL

95573
Campion Laboratories Inc.
Detroit, MI

95712
Bendix Corp.
Electrical Comp. Div.
Franklin, IN

95987
Weckesser Co. Inc.
(Now 85480)

96733
SFE Technologies
San Fernando, CA

96853
Gulton Industries Inc.
Measurement & Controls Div.
Manchester, NH

96881
Thomson Industries Inc.
Port WA, NY

97464
Industrial Retainer Ring
Irvington, NJ

97525
EECO Inc.
Santa Ana, CA

97540
Whitehall Electronics Corp.
Master Mobile Mounts Div.
Fort Meyers, FL

97913
Industrial Electronic
Hardware Corp.
NY, NY

97945
Pennwalt Corp.
SS White Industrial Products
Piscataway, NJ

97966
CBS
Electronic Div.
Danvers, MA

98094
Machlett Laboratories Inc.
Santa Barbara. CA

98159
Rubber-Teck Inc.
Gardena, CA

98278
Malco A Microdot Co.
South Pasadena, CA

98291
Sealectro Corp.
BICC Electronics
Trumbill, CT

98372
Royal Industries Inc.
(Now 62793)

98388
Lear Siegler Inc.
Accurate Products Div.
San Deigo, CA

98978
IERC
(International Electronic Research Corp.)
Burbank, CA

99120
Plastic Capacitors Inc.
Chicago, IL

99217
Bell Industries Inc.
Elect. Distributor Div.
Sunnyvale, CA

99378
ATLEE of DE Inc.
N. Andover, MA

99392
Mepco/Electra Inc.
Roxboro Div.
Roxboro, NC

99515
Electron Products Inc.
Div. of American Capacitors
Duarte, CA

99779
Bunker Ramo- Eltra Corp.
Barnes Div.
Lansdown, PA

99800
American Precision Industries
Delevan Div.
East Aurora, NY

99942
Mepco/Centralab
A North American Philips Co.
Milwaukee, WI

Service Centers

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California
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FAX: (510) 651-4962

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Irvine, CA 92714
TEL: (714) 863-9031
FAX: (714) 757-7556

Florida
Fluke Service Center
550 S. North Lake Blvd.
Altamonte Springs, FL 32701-5227
TEL: (407) 331-2929
FAX: (407) 331-3366 or 331-7710

Illinois
Fluke Service Center
1150 W. Euclid Avenue
Palatine, IL 60067
TEL: (708) 705-0500
FAX: (708) 705-9989

New Jersey
Fluke Service Center
W. 75 Century Rd
or P.O. Box 930
Paramus, N.J. 07652
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FAX: (201) 599-2093

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2104 Hutton Drive
Suite 112
Carrollton, TX 75006
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FAX: (214) 406-1072

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Everett WA 98203
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FAX: (206) 356-6390

INTERNATIONAL

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Virrey del Pino 4071
1430 CAP FED
Buenos Aires
TEL: 54-1-552-5248
FAX: 54-1-11-1427

Viditec S.A
Lacarra 234
Buenos Aires CP 1407
TEL: 54-1-636-1199
FAX: 54-1-636-2185

Australia
Phillips Customer Support
Scientific and Industrial
23 Lakeside Drive
Tally Ho Technology Park
East Burwood
Victoria 3151
TEL: 61-3-881-3666
FAX: 61-3-881-3636

Phillips Customer Support
Scientific and Industrial
Block F, Centrecourt
34 Waterloo Road
North Ryde, N.S.W. 2113
TEL: 61-2-888-0416
FAX: 61-2-888-0440

Austria
Fluke Vertriebsges. m.b.H.
SudrandstraBe 7
P.O. Box 10
A-1232 Vienna
TEL: 43-1-614-100
FAX: 43-1-61410-10

Belgium
N.V. Fluke Belgium/S.A.
T&M Customer Support
Langeveldpark - Unit 5 & 7
P.Basteleusstraat 2-4-6
1600 St. Pieters - Leeuw
TEL: 218-2-331-2777
FAX: 32-2-331-1489

Bolivia
Coasin Bolivia S.R.L.
Casilla 7295
La Paz, Bolivia
TEL: 591-2-340962
FAX: 591-2-359268

Canada
Fluke Electronics Canada Inc.
400 Britannia Road East, Unit #1
Mississauga, Ontario
L4Z 1X9
TEL: 905-890-7600
FAX: 905-890-6866

Chile
Intronica
Instrumentacion Electronica, S.A.C.I.
Guardia Vieja 181 Of. 503
Casilla 16500
Santiago 9
Chile
TEL: 56-2-232-3888
FAX: 56-2-231-6700

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Fluke Service Center
Room 2111 Scite Tower
Jianguomenwai Dajie
Beijing 100004
TEL: 86-1-512-3435 or 6351
FAX: 86-1-512-3437

Colombia
Sistemas E Instrumentacion, Ltda.
Carrera 21, NO. 39A-21, OF. 101
Ap. Aereo 29583
Bogota
TEL: 57-1-287-5424
FAX: 57-1-287-•248

Costa Rica
Electronic Engineering, S.A.
Carretera de Circunvalacion
Sabanilla Av. Novena
P.O. Box 4300-1000
San Jose
TEL: 506-253-3759
FAX: 506-225-1286

Danmark
Fluke Danmark A/S
T&M Customer Support
Ejby Industrivej 40
DK 2600 Glostrup
TEL: 45-43-44-1900
FAX: 45-43-43-9192

Ecuador
Proteco Coasin Cia., Ltda.
Av. 12 de Octubre 2449 y Orellana
P.O. Box 17-03-228-A
Quito
TEL: 593-2-230283 or 520005
FAX: 593-2-561980

Fiji
Communications Pacific, Ltd.
37 Freeston Road
Walu Bay
G.P.O. Box 858
Suva
TEL: 679 312744
FAX: 679 300379

Finland
Fluke Finland Oy
Sinikalliontie 3
SF-02631 Espoo
TEL: 358-0-5026-6247
FAX: 358-0-5026-414

France
Fluke France S.A.
37 Rue Voltaire
BP 112
93700 Drancy,
TEL: 33-1-48-966361
FAX: 33-1-48-966330

Germany
Fluke Deutschland Gmbh
Service & Calibration Lab.
Oskar-Messter-Strasse 18
85737 Ismaning/Munich
TEL: 49-89-99611-260
FAX: 49-89-99611-270

Fluke Deutschland
Test & Measurement
Meiendorferstrasse 205
22145 Hamburg 73
TEL: 49-40-6797-434
FAX: 49-40-6797-421

Hong Kong
Schmidt & Co (H.K.) Ltd.
1st Floor
323 Jaffe Road
TEL: 852-9223-5623
FAX: 852 834-1848

Ireland, Republic of
Fluke U.K. LTD.
Customer Support
Colonial Way
Watford
Hertfordshire WD2 4TT U.K.
TEL: 44-923-240511
FAX: 44-923-225067

India
Hinditron Services Pvt. Inc.
33/44 Rajmahal Vilas Extension
8th Main Rd.
Bangalore 560 080
TEL: 91-80-334-8266
FAX: 91-80-3345022

Hinditron Services Pvt. Ltd
1st Floor, 17-B,
Mahal Industrial Estate
Mahakali Road, Andheri East
Bombay 400 093
TEL: 91-22-837-0013
FAX: 91-22-837-0087

Hinditron Services Pvt. Ltd
Castle House, 5th Floor
5/1 A, Hungerford Street
Calcutta 700 017

Hinditron Services Pvt. Ltd
15 Harrington Road
Chetpet
Madras 600031

Service Centers (cont)

Hindtron Services Pvt. Ltd.
204-206 Hemkunt Tower
98 Nehru Place
New Delhi 110 019
TEL: 91-11-641-0380
FAX: 91-11-642-9118

Hinditron Services Pvt. Ltd.
Field Service Center
Emerald House
5th Floor
114 Sarojini Devi Road
Secunderabad 500 003
TEL: 91 842-844033

Indonesia
P. T. Daeng Brothers
Phillips House
J/n H.R. Rasuna Said Kav. 3-4
Jakarta 12950
TEL: 62-21-520-1122
FAX: 62-21-520-5189

R.D.T Equipment and Systems, Ltd.
P.O. Box 58072
Tel Aviv 61580
TEL: 972-3-645-0745
FAX: 972-3-647-8908

Italy
Fluke Italia S.R.L.
T&M Customer Support
Viale Delle Industrie, II
20090 Vimodrone (MI)
TEL: 39-2-268434-435
FAX: 39-2-250-1645

Japan
Fluke Corporation
Sumitomo Higashi Shinbashi Bldg.
1-1-11 Hamamatsucho
Minato-ku
Tokyo 105
TEL: 81-3-3434-0188
FAX: 81-3-3434-0170

Korea
B&P International Co., Ltd.
Geopung Tocon A-1809
203-1 Nonhyun-Dong
Kangnam-Ku
Seoul 135-010
TEL: 82 02 546-1457
FAX: 82 02 546-1458

IL MYOUNG, INC.
780-46, Yeogsam-Dong
Youngdong P.O. Box 1486
Kangnam-Ku
Seoul
TEL: 82 2 552-8582-4
FAX: 82 2 553-0388

Malaysia
CNN. SDN. BHD.
17D, 2nd Floor
Lebuhraya Batu Lancang
Taman Seri Damai
11600 Jelutong Penang
TEL: 60-4-657-9584
FAX: 60-4-657-0835

Mexico
Mexel Mexicana De Electronica Industrial, S.A. De C.V.
Diagonal No. 27
Entra Calle de Eugenia Y Ave.
Col. Del Valle
C.P. 03100, Mexico D.F.
TEL: 52-5-682-8040
FAX: 52-5-687-8695

Mexicana De Electronica Industrial, S.A.
F-14 Bassett Center #541
6001 Gateway West
ElPaso, TX 79925
TEL: 52-16-23-02-35
FAX: 52-16-23-02-35

Netherlands
Fluke Europe B.V.
Test & Measurement
Science Park
Eindhoven 5110
P.O. Box 1337
5602 BH Eindhoven
TEL: 31-40-644-226
FAX: 31-40-644-260

Fluke Netherland B.V.
Technische Service Prof. Act.
Hurksestraat, 2C
Gebouw HBR
5652 AJ Eindhoven
TEL: 31-40-722-626
FAX: 31-40-723-337

New Zealand
Phillips Customer Support
Scientific & Industrial
Private Bag 41904
St. Lukes, 2 Wagener Place
Mt. Albert, Auckland 3
TEL: 64-9-894-4160
FAX: 64-9-849-7814

Norway
Fluke Norway A/S
Customer Support
P.O. Box 6054 Etterstad
N-0601 Oslo
TEL: 47-22-653400
FAX: 47-22-653407

Pakistan (Philips)
Philips Electrical Industries of Pakistan, Ltd.
Islamic Chamber of Commerce Industry and Commodity Exchange Bldg.
St-2/A, Block 9, KDA Scheme 5,
Clifton, Karachi-75600
Pakistan

Peru
Importaciones & Representaciones Electronicas S.A.
JR. Pumacahua 955
Lima 11
TEL: 51-14-23-5099
FAX: 51-14-31-0707

Philippines
Spark Electronics Corp.
P.O. Box 610, Greenhills
Metro Manila 1502
TEL: 63-2-700-621
FAX: 63-2-721-0491

Portugal
Fluke Iberica, S.L.
IE Division - T&M Department
(Delegacao em Portugal)
Campo Grande, 35-7oB
1700 Lisboa
TEL: 351-1-795-1712
FAX: 351-1-795-1713

Singapore
Fluke Corporation
Singapore Representative Office
#27-03 PSA Building
460 Alexandra Road
Singapore 0511
TEL: 65-276-5161
FAX: 65-276-5759

South Africa
Spescom Measuregraph (PTY) Ltd.
Spescom Park
Crn. Alexandra Rd. & Second St.
Halfway House, Midrand 1695
TEL: 27-11-315-0757
FAX: 27-11-805-1192

Spain
Fluke Iberica S.L.
Centro Empresarial Euronora
c/Ronda de Poniente, 8
28760-Tres Cantos
Madrid, Spain
TEL: 34-1-804-2301
FAX: 34-1-804-2496

Sweden
Fluke Sverige AB
T&M Customer Support
Kronborgsgrand 11
P.O. Box 61
S-164 94
TEL: 46-8-751-0235
FAX: 46-8-751-0480

Switzerland
Fluke Switzerland AG
T&M Customer Support
Rutistrasse 28
8952 Schlieven
Switzerland
TEL: 41-1-730-3310
FAX: 41-1-730-3932

Taiwan
Schmidt Electronics Corp.
5th Floor, Cathay Min Sheng Commercial Building,
No. 178 Sec. 2
Min Sheng East Road
Taipei
TEL: 886-2-501-3468
FAX: 886-2-502-9692

Thailand
Measuretronix Ltd.
2102/31 Ramkamhang Road
Bangkok 10240
TEL: 66-2-375-2733, 375-2734
FAX: 66-2-374-9965

United Kingdom
Fluke U.K. LTD.
Customer Support
Colonial Way
Watford
Hertfordshire WD2 4TT
TEL: 44-923-240511
FAX: 44-923-225067

Uruguay
Coasin Uruguaya S.A.
Casilla de Correo 1400
Libertad 2529
Montevideo
TEL: 598-2-789-015
FAX: 598-2-492-199

Venezuela
Coasin C.A.
Calle 9 Con Calle 4, Edif. Edinurbi
Apartado de Correos NR-70.136
Los Ruices
Caracas 1070-A
TEL: 58-2-241-0309, 241-1248
FAX: 58-2-241-1939

Vietnam
Schmidt-Vietnam Co., Ltd.
6/Fl.Fedalogical College Bldg.
Dich Vong, KM 8 Highway 32
Tu Liem - Hanoi
TEL: 84-4-346186
FAX: 84-4-346188

Section 8
Schematic Diagrams

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